MBL/WHOI
0 0301 0062914 3

Published monthly by the

New York State Education Department

BULLETIN 343 JUNE 1905

New York State Museum

JOHN M. CLARKE Director

EPHRAIM PORTER FELT State Entomologist

Bulletin 86

ENTOMOLOGY 23

MAY FLIES AND MIDGES OF NEW YORK

THIRD REPORT ON AQUATIC INSECTS

A study conducted at the entomologic field station, Ithaca N. Y. under the direction of

EPHRAIM PORTER FELT D.Sc.

BY

JAMES G. NEEDHAM Ph.D. Professor of biology, Lake Forest College

KENNETH J. MORTON F.E.S.L. Edinburgh, Scotland

O. A. JOHANNSEN M.S. Instructor in civil engineering, Cornell University

	PAGE
Preface	4
Introduction	7
Summer Food of the Bullfrog at Saranac Inn. J. G. NEEDHAM	9
Ephemeridae. J. G. NEEDHAM	17
North American Hydroptilidae. K. J. MORTON	63
Aquatic Nematocerous Diptera II. O. A. JOHANNSEN	76
Explanation to the plates	316
Legenda to text figures	331
Plates 1–37	face 332
Index	333

MARINE BIOLOGICAL LABORATORY WOODS HOLE LIBRARY MASS.

ALBANY

NEW YORK STATE EDUCATION DEPARTMENT

1905

Me14m-S4-2905

Price 80 cents

STATE OF NEW YORK

EDUCATION DEPARTMENT

Regents of the University

With years when terms expire

1913 Whitelaw Reid M.A. LL.D. *Chancellor* - - - New York
1906 St Clair McKelway M.A. L.H.D. LL.D. D.C.L.
Vice Chancellor - - - - - - - - - - - Brooklyn
1908 Daniel Beach Ph.D. LL.D. - - - - - - - - Watkins
1914 Pliny T. Sexton LL.D. - - - - - - - - - Palmyra
1912 T. Guilford Smith M.A. C.E. LL.D. - - - - Buffalo
1907 William Nottingham M.A. Ph.D. LL.D. - - Syracuse
1910 Charles A. Gardiner Ph.D. L.H.D. LL.D. D.C.L. New York
1915 Charles S. Francis B.S. - - - - - - - - - Troy
1911 Edward Lauterbach M.A. - - - - - - - - New York
1909 Eugene A. Philbin LL.B. LL.D. - - - - - New York
1916 Lucian L. Shedden LL.B. - - - - - - - - Plattsburg

Commissioner of Education

Andrew S. Draper LL.D.

Assistant Commissioners

Howard J. Rogers M.A. LL.D. *First Assistant Commissioner*
Edward J. Goodwin Lit.D. *Second Assistant Commissioner*
Augustus S. Downing M.A. *Third Assistant Commissioner*

Secretary to the Commissioner

Harlan H. Horner B.A.

Director of Libraries and Home Education

Melvil Dewey LL.D.

Director of Science and State Museum

John M. Clarke LL.D.

Chiefs of Divisions

Accounts, William Mason
Attendance, James D. Sullivan
Examinations, Charles F. Wheelock B.S.
Inspections, Frank H. Wood M.A.
Law, Thomas E. Finegan M.A.
Records, Charles E. Fitch L.H.D.
Statistics, Hiram C. Case

State Museum, Albany N. Y. Oct. 17, 1904

Hon. Andrew S. Draper

Commissioner of Education, Capitol

SIR: I beg to transmit herewith, for publication as a bulletin of this division, a third report on aquatic insects, entitled *May Flies and Midges of New York* by Dr J. G. Needham, Special Assistant to the State Entomologist.

Very respectfully

JOHN M. CLARKE

Director

State of New York
Education Department
COMMISSIONER'S ROOM

Approved for publication Oct. 24, 1904

A. S. Draper

Commissioner of Education

PREFACE

This, the third report upon work begun in 1900, like its predecessors, marks an important advance in knowledge. The first report, State Museum Bulletin 47, consisting of 230 pages and 36 plates, gave the life histories of about one hundred aquatic forms and characterized ten species and two new genera. The most important portion of this work was the monographic account of the larger dragon flies (Odonata Anisoptera). There were also valuable additions to our knowledge of the stone flies (Plecoptera) and the May flies (Ephemeridae), and the admirable account of the Caddis flies (Trichoptera), by Mr Betten, deserves special mention because of its careful biologic treatment of a heretofore much neglected group. The second report, State Museum Bulletin 68, comprised 419 pages and 52 plates and was a continuation of the preceding. The monograph of the Odonata is completed by an exhaustive account of the smaller dragon flies (Zygoptera). Among the important contributions may be mentioned: The key to Coleopterous larvae with an account of some aquatic Chrysomelidae by Dr MacGillivray, the discussion of certain aquatic nematocerous Diptera by Dr Johannsen, and a monograph on the Sialididae of the Western Hemisphere. The present report is a continuation of the work, and among its valuable features should be noted the monographic account of our May flies, a group of great importance as food for fish. The small midges, belonging to the Chironomidae, are very important as fish-food and have been treated exhaustively by Mr Johannsen. These three publications mark a most decided advance in our knowledge of aquatic forms and, with the publication of the monograph on stone flies now in preparation, a large fund of information will be available for the student of aquatic forms.

This study, as was pointed out in the introduction to the first report, has been made upon broad lines with the avowed purpose of producing something of value to the fish culturist, who must first of all be able to identify aquatic forms, something well-nigh

impossible, before these reports were made public. The investigations of Dr S. A. Forbes of Illinois convinced him that nearly one-fifth of the entire amount of food consumed by all adult fishes examined by him consisted of aquatic neuropteroid larvae, the greater part of them being the young of May flies. It may never be possible to rear aquatic insects for the purpose of feeding fish, but it certainly is feasible in some instances to provide conditions adapted to multiplication of aquatic insects, and therefore valuable as feeding grounds for fish. The history of the shellfish industry gives a little idea of the possibilities along this line. A number of years ago it was at a very low ebb, owing to unscientific methods in vogue and the lack of individual control. This has been changed and we now have a thriving industry producing over two million dollars ($2,309,758) worth of products, according to the report of the United States Fish Commission for 1900. It is exceedingly difficult to obtain figures relating to the value of our fresh-water fishes, but a compilation from the report of the United States Fish Commission for the year 1900 gives the total value of fresh-water fish in the Hudson river valley and Long Island at over one million dollars ($1,192,544), and the report for 1901 places the value of fresh-water fish obtained in the State from the Great Lakes at nearly one-fourth a million ($241,916). These figures, it will be observed, give no idea of the value of fresh-water fish taken in various lakes and streams throughout the State, aside from the areas mentioned above. Comparing the water areas available for shellfish culture and those suitable for the development of fresh-water fish, it will be seen that there is a considerable discrepancy in favor of the latter and yet the value of the product is much smaller. It is stated that a large proportion of the market fish of China are grown in ponds, and that carp culture is an important industry not only in China but in Germany, and that formerly carp were extensively reared in England. Germany and Sweden, and lately France, have also done considerable along this line.

It is hardly likely that this country will adopt Chinese methods, because the great difference in the price of labor makes it impracticable; still the proper knowledge of the conditions suitable

for the growth and multiplication of fish may put it within the power of many to make substantial additions to the productivity of areas under control, without great increase in the cost of management. These investigations have been conducted primarily to ascertain the relations existing between fish and insects they feed upon, and the conditions necessary for the development of large amounts of fish-food. Much of the preliminary work has been accomplished, and the data already obtained should prove of great service to parties interested in fish culture, especially in making heretofore barren waters productive.

E. P. Felt
State Entomologist

New York State Education Department

New York State Museum

John M. Clarke Director

Bulletin 86

ENTOMOLOGY 23

MAY FLIES AND MIDGES OF NEW YORK

I. INTRODUCTION.

BY JAMES G. NEEDHAM

This bulletin includes further results of the study of material gathered under the auspices of the New York entomologic field station, and is therefore complementary to bulletins 47 and 68 of this same series. Bulletin 47 contains the more general results of the first field season spent at Saranac Inn, introductory keys to aquatic insect larvae, numerous life histories, and a detailed report of the dragonflies (Odonata-Anisoptera) of New York State. Bulletin 68 contains the main results of the second field season spent at Ithaca, further life histories, detailed reports on the damselflies (Odonata-Zygoptera) of the state, on aquatic plant-beetles (Chrysomelidae), on certain families of nematocerous diptera, and on American Sialididae; also, an account of the food of the brook trout in Bone pond.

This bulletin contains the work of three collaborators who have labored apart on the remaining material gathered for the station. Mr O. A. Johannsen furnishes the major part, in the form of a completed review of the Chironomidae. Notwithstanding that these little gnats are enormously abundant everywhere and are of first importance among insects affecting fish culture, this is the first American monograph we have had dealing with the family to which they belong. It is a generic treatment of the world fauna, together with detailed descriptions and life histories (mostly new) of our known species. It is a

work of first importance, and will doubtless serve as a basis for future studies in this long-neglected family.

Mr K. J. Morton of Edinburgh contributes a paper on the micro-caddisflies of the family Hydroptilidae of Trichoptera, which is practically the beginning of the study of this group in America.

My own part in this bulletin is a second contribution to the knowledge of our may-flies. Because of the great economic importance of this group also, I have thought it worth while to attempt to provide American students with a better introduction to the study of the group than has hitherto been generally available. Hence, in addition to new life histories, I have prepared new generic keys to both nymphs and adults, which, with the detailed explanations and figures, should enable even a novice to take up the study of this neglected group with some hope of success.

I have also prepared a brief report on the summer food of the bullfrog (Rana catesbiana Shaw) at Saranac Inn, and in the discussion of that food have included a number of ecological and systematic notes, among which is a new key to our genera of Hemerobiidae.

I planned also to include herein a report on the stoneflies (Perlidae) and did much work to that end: but the station collections are large, and much material has come to me from friends outside, and my manuscript has grown until it now seems better not to include it herein, but to make a separate bulletin of it. I am therefore continuing the work with the purpose of making the next station bulletin a monograph of North American Perlidae. I should be greatly obliged if American collectors who have even a few specimens would send me them for study.

In this place I may add a note supplementary to bulletin 68. The "unknown tipulid larva from a spring" described on pp.285-286 and figured in pl.10, figs.4-5, is Pedicia albivitta Walker. Had Beling's third paper on Tipulid larvae (Verh. zool.-bot. Ges. Wiel, vol. 36) been available to me when I was studying this larvae, I should have been able to determine it from his keys and description. The "unknown leptid larva from rapid streams" of p.286 and pl.10, fig.1, is doubtless a

species of Atherix, as has been kindly indicated to me in correspondence by both Professor A. Giard of Paris and Dr R. Lauterborn of Ludwigshafen.

THE SUMMER FOOD OF THE BULLFROG (RANA CATESBIANA SHAW) AT SARANAC INN

(With plate 1)

BY JAMES G. NEEDHAM

Bullfrogs are common at Saranac Inn. Any warm evening their sonorous notes may be heard reverberating through the tamarack swamps, echoing and reechoing across Little Clear pond between Green hill and the outlet, or rising with a startling crescendo near at hand from the shallows of the reedy creek, setting the thread-rushes trembling, and fretting the face of the water with infinitesimal wavelets, striking with wonder and admiration the ears of the stranger accustomed only to the vocal powers of the lesser civilized frogs. By day they sit in the edge of the water, stolidly basking in the sunshine, picking a straying bee or dragonfly out of the air, or lapping a floating ant or an emerging caddisfly from the surface of the water, eating much or little according to the bestowal of Providence, and when alarmed by our too close approach, plunging away with a single dilatory and awkward leap into deeper water. Their tadpoles, likewise of phenomenal size, are to be seen about the submerged timbers in Little Clear pond and creek. They are oftenest observed resting upon the logs in the sunshine. Frequently, when crossing the bridge over Big Clear creek on the Otisville road during our first field season, I stopped to watch them sunning themselves on the submerged bridge timbers, and often dropped pebbles upon them to see them swim away. They would wriggle and sidle and slide off the timbers, and then with a motion that appeared most deliberate strike a straight course obliquely downward far away across the clear deep waters of the stream, moving slowly forward by sculling undulations of the enormous banner-like tail.

During July and August, 1900, I preserved the food of a number of adult bullfrogs from Little Clear creek, taking the stomachs of chance specimens that were killed for food and preserving and

cleaning the contents. Most of the specimens were obtained for me by my friend Dr O. S. Westcott of Chicago, who was visiting the station at that time. I suggested that he test the efficiency of a hook and line baited with a little piece of red silk flirted near the bullfrogs' heads. He reported the capture of every specimen properly approached; said that bullfrogs are abject idiots; said that if one is not hooked at his first dash for the dangling cloth, but gets his mouth snagged, he will go for the bait again and again as eagerly as at first. It is indeed remarkable how the predatory reflexes incited by the sight of the dangling red cloth prevail over the effects of the wounds.

There now remain in the New York State collection the preserved contents of the stomachs of fifteen of these frogs, and I have studied this material, with the aid of Mr W. H. Ferguson, and report on it here. The following table is largely the work of Mr Ferguson. I have added to it the single record published in bulletin 47 p.401, making 16 in all.

The traditional account of the manner of the bullfrog's feeding pictures him sitting immobile on a bank, watching for insects passing through the air, and, when these approach, capturing them by flirting out his long, bifurcated, sticky tongue and striking them. The picture is incomplete. Doubtless he captures some of the bees and hover flies and others of the fleetest insects in just this way, but the larger, heavier and slower ones he endeavors to meet half way. For instance, on the approach of a big caddisfly or a blackwing damselfly, he becomes greatly excited, especially after an unsuccessful stroke at it, and leaps and plunges toward it with tongue and jaws both reaching for it. Some of the larger of his captives would not be held by the adhesiveness of his tongue without the immediate assistance of his jaws. Moreover, the greater part of his food is not obtained from the air at all, but from plants, from the ground, and from the water, and doubtless, by more deliberate methods. The caterpillars and sawfly larvae of the table were probably picked from plants; the beetles and millipedes from the ground; the water striders, floating dead insects, soldierfly larvae, gnat pupae, and transforming caddisflies from the surface of the water; and the mayfly nymph, gnat larvae and some of the snails probably from beneath the water.

Table of food of 16 bullfrogs

No.	Snails	Crustaceans	Spiders	Millipedes	HYMENOPTERA			COLEOPTERA			DIPTERA			TRICHOPTERA		ODONATA		Hemiptera	Orthoptera	Neuroptera	Lepidoptera	Ephemerida	Miscellaneous
					Ants	Bees	Others	Carabidae	Other adults	Larvae	Adults	Pupae	Larvae	Teneral adults	Sand	Adults	Nymphs and eggs						
1	1	....	1	....	1	....	1	3	....	....	1	1	12	....	....	....	....	6	1	....	1	....	Flower clusters and algae
2	....	....	1	....	3	2	....	1	....	....	2	1	....	1	....	1	1	8	1	....	....	....	
3	....	....	1	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	1	1	....	....	Bur-reed stem; hemlock leaves
4	....	....	....	....	1	....	....	1	....	....	1	....	....	....	....	....	....	....	1	1	....	....	Hemlock leaves
5	....	....	....	....	....	....	....	....	1	....	2	....	....	....	....	1	e	1	....	....	....	....	Hemlock leaves and algae
6	6	....	....	....	1	....	....	....	1	....	3	....	....	1	....	1	....	....	1	....	....	....	
7	....	1	....	1	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	Hemlock leaves and 4 pine leaves
8	....	....	....	....	2	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	Birch bark
9	3	....	....	....	....	....	....	2	....	....	1	....	....	....	....	2	....	....	....	1	....	....	Hemlock leaves
10	....	....	....	1	1	1	....	2	....	1	2	....	....	1	....	1	....	1	....	....	....	....	Hemlock leaves and algae
11	....	....	....	....	1	1	1	2	....	....	3	....	1	1	....	2	....	1	....	....	1	....	Hemlock leaves and algae
12	....	1	....	....	1	2	1	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	
13	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	..	1	....	....	....	Leaf fragments
14	....	....	....	....	....	....	....	....	....	....	....	10	2	8	....	....	....	....	....	....	....	1	
15	7	1	....	....	1	....	....	....	1	....	....	....	....	1	1	1	. ..	1	....	....	....	....	Bullfrog tadpole
16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	Meadow mouse
Tot.	18	3	3	2	12	7	3	11	3	2	15	12	15	15	4	9	2	19	6	3	2	1	
					22			16			42					11							

Notes on the Food

General. Leaving aside the plant fragments eaten, which were of considerable number and variety, which were obtained both from the water and the air (as shown by the presence of filamentous algae and a broken flower cluster in the same stomach), but which were probably all obtained accidentally along with animal food, there were present the remains of 164 animals. Of these the largest number, 139, were insects, 18 were snails, 3 were crustacea, 3 were spiders, and 2 were vertebrates. The most important part of the food is doubtless insects and snails; the former in great variety, the latter consisting of a single species. Leaving aside frog no. 16, whose stomach contained only a large meadow mouse, the other 15 had eaten on an average 9 insects and 1.2 snails apiece.

Of the insects eaten two were millipedes (apparently Julus, but not in condition to identify with certainty) and the remainder were hexapods. The ten orders present had the following numerical representation: Diptera, 42; Hymenoptera, 22; Hemiptera, 19; Coleoptera, 16; Trichoptera, 15 (not including 4 whose presence was evidenced only by sand supposed to have been derived from larval cases); Odonata, 11, and a large mass of eggs of Tetragoneuria; Orthoptera, 6; Neuroptera, 3; Lepidoptera, 2 (larvae); Ephemeridae, 1 (nymph). Of these the six orders first named were present in fairly equivalent proportions, and these, with the snail, Physa heterostropha, may be said to constitute the staple food of the bullfrog in summer at Saranac Inn. The bulk of the snails eaten was certainly greater than that of the insects of any single order. The largest animal eaten was the meadow mouse, and next in size were the two crawfishes.

Vertebrates. There were two vertebrates eaten; frog no. 16 had eaten nothing but a short-tailed meadow mouse (Arvicola pennsylvanicus) of large size; that was enough to fill his stomach to its full capacity. How he came by this sumptuous morsel I am unable to understand unless he found it dead and floating down the creek. Frog no. 15 had swallowed a yearling tadpole of his own species.

Crustaceans. Frogs nos. 7 and 12 had each eaten a crawfish, of which there remained as evidence only the chelipeds. These indicated half-grown individuals of the genus Cambarus. Frog no. 15 had eaten, probably by accident, a minute and undetermined copepod.

Hymenoptera. These collections were made during the season of flight of the winged males and females of the big carpenter ant (Camponotus pennsylvanicus) remains of which were found in nine stomachs. Thus this species occurred a greater number of times than any other. Stranded specimens were frequently seen floating down the creek, and the frogs may as well have obtained them from the surface as from the air. Worker bumble bees (Bombus ternarius Say and B. consimilis Cr.) were found in five stomachs, and these were doubtless obtained alive. The bullfrog would seem to be, like the brook trout, immune to bee poison. The other hymenoptera were but three; a wasp (Vespa diabolica Sauss.) in frog no. 12, a sawfly larva in frog no. 1, and a minute parasitic hymenopter in frog No. 11.

Coleoptera. Of the 16 specimens of this order eaten 12 were Carabidae (11 adults and one larva), and there were single adults of Scarabaeidae, Chrysomelidae, and Curculionidae, and a single larva of Elateridae.

Diptera. This order was represented by the largest number of individuals, but many of them were very small. Six families were represented: Tipulidae, Chironomidae, Stratiomyidae, Syrphidae, Tabanidae, and Tachinidae.

A single adult Tabanid was eaten, two adult Tachinids, four adult Syrphids, the better preserved appearing to belong to the genus Eristalis, five adult Tipulidae, all belonging to moderate sized species of the genus Tipula. There was a single adult Chironomid, but there were eleven pupae, ten of them from frog no. 14, all belonging to the genus Chironomus and one larva from the same frog belonging to the same genus and one belonging in Ceratopogon. A sixth family, Stratiomyiidae, was represented by twelve larvae of Stratiomyia badius? from frog no. 1. In bulletin 47, p.576, I have recorded that I could find but a single specimen

of this species during the season. Of the total of 42 Diptera eaten 27 were larvae and pupae, and these must have been obtained from the water.

Trichoptera. With the single exception of the large Neuronia postica eaten by frog no. 3, all the other caddisflies were teneral imagos, captured probably as they came to the surface in transformation. This was evidenced by the pupal skins still hanging to many of the specimens. All were in bad condition in consequence, and in determining them I placed chief reliance on the characters of the pupal skins. I was able to assure myself that about nine of the specimens belonged to the genus Halesus and another to Hydropsyche. The sand found in four of the stomachs seemed to indicate that larvae in their cases had been eaten earlier and entirely digested. Larvae of Polycentropus lucidus and Molanna cinerea are sufficiently available in Little Clear creek. I have shown in bulletin 68 that the brook trout in Bone pond swallow the larvae of another species case and all.

Odonata. Drangonflies constituted as large a part of the food as any other single group of insects. Although the number was but eleven, the size of the individuals was relatively large, the adult Aeschna and the nymph of Anax being among the largest insects eaten. Four adult and apparently fully colored blackwings, Calopteryx maculata, two adults of Argia violacea and single undetermined specimens of Lestes, Enallagma and Æschna make up the list, together with a nymph of Anax junius and an undetermined nymph of the subfamily Agrioninae. The adults, so far as might be determined, were all females and might have been obtained while ovipositing. Frog no. 4 had swallowed a considerable mass of eggs of Tetragoneuria. In bulletin 47, pp.490-492 (with fig.19) I have given an account of these eggs. The frog probably found a cluster unusually close in shore.

Hemiptera. The water skaters (Hydrotrechus sp?) constitute an important and fairly constant element of the food, 16 of the 19 specimens found being of this genus.

Orthoptera. Five grasshoppers were found singly, the one in condition fit for determination being Melanoplus femo-

ratus and one grouse locust. Considering the abundance of these about the edges of the creek, I was somewhat surprised that more had not been eaten. As many as this may easily have been picked from the surface of the water.

Lepidoptera. Two moth larvae only.

Ephemeridae. A single nymph of Siphlurus alternatus Say was eaten by frog no. 14. It must have been taken beneath the surface of the water as these nymphs do not come to the surface, so far as I have observed, except to transform, and this one was not ready for transformation. I have given an account of the habits of the nymph of this species in bulletin 47 p.424. It was a surprise to me that no adult May flies were eaten.

Neuroptera. Amphibian stomachs offer a new field for collecting representatives of this order, a field in which I have made some of my best finds, and that in a very little material. I found Sisyra umbrata Ndm. first in the stomach of a tree frog, as recorded in Psyche vol.10, p.29, and these bullfrog stomachs contained specimens of a new species of Micromus, and of Climacia dictyona Ndm. and Hemerobius amiculus Fitch,—single specimens of each.

SYSTEMATIC NOTES ON HEMEROBIIDAE

Micromus jonas sp.nov.

Allied to M. angulatus, but smaller; expanse 10mm. Known only from its wings, but these alone will distinguish it (pl.3, fig.2). The fore wing is 4.7mm. long and 2mm. wide, with front and hind margins nearly parallel in their middle third. Their color is rich fulvous, with darker fuscous oblique streaks along the line of both the gradate series, and less distinct, more transverse marmorate lines between, which become arcuate where they traverse the bases of the apical forks beyond the second gradate series; hind wings pale fulvous about margins, the disc transparent, and the veins traversing it very angulate in their course with crossveins incomplete. Gradate veins in fore wing; inner series 5, outer series 4-5; in hind wing; inner series, 3-4, outer series 3-4. Saranac Inn, N. Y. Taken from bullfrog stomach (no.9 of table) in July, 1900.

I have in hand a study of the venation of the Hemerobiidae. This material, especially Hemerobius amiculus Fitch, and another of Fitch's rare species, H. occidentalis from Illinois (which I have recently received from Wisconsin), together with other species of Hemerobius collected at Saranac Inn, Ithaca and in Illinois, have thrown some light on the evolution of the peculiar Hemerobian type of venation. My study will in due time be published elsewhere when it is completed; and the results to be noted here are merely that H. amiculus Fitch and H. occidentalis Fitch represent two stages in the evolution of the type which should be marked by generic rank. I therefore characterize them here and in the form of a key, because the key to Hemerobiidae in bulletin 47 was not made complete for our genera:

KEY TO THE GENERA OF HEMEROBIIDAE

a Branches of the radial sector arising (*i. e.*, separating from vein R_1) by a common stalk
b With three ocelli..... Dilar
bb With no ocelli
c Humeral crossvein (the basal costal crossvein) simple and not recurrent
d Some of the branches of vein Cu_1 forked.. Sisyra
dd All of the branches of vein Cu_1 simple.... Climacia
cc Humeral crossvein recurrent and bearing a number of branches on its outer side
d Subcosta and radius separate at the tips.. Polystoechotes
dd Subcosta and radius conjoined at the tips.. Berotha
aa Branches of the radial sector appearing to arise separately from vein R_1
b Humeral crossvein unbranched and not recurrent (pl.3, figs. 1 and 2)..... Micromus
bb Humeral crossvein recurrent and with branches on its outer side
c First division of the radial sector arising before or opposite the basal subcostal crossvein; in the hind wing the vein M_{1+2} is well separated from the base of the radial sector, with a distinct crossvein between
d A closed cell in the first fork of the radius before the base of the second division of the sector (pl.2, fig.2); front coxae longer than the femora
Spadobius n. gen. type H. occidentalis Fitch

dd No closed cell in the first fork of the radial sector before the base of the second division of the sector (pl.3, fig.3); coxae of fore legs shorter than femora
Palmobius n. gen. type H. amiculus Fitch

cc First of the three or four divisions of the radial sector arising well beyond the basal subcostal crossvein (pl.2, fig.1); in the hind wing vein M_{1+2} is more or less confluent with the base of the radial sector, eliminating or reducing the crossvein between ..... Hemerobius

EPHEMERIDAE

BY JAMES G. NEEDHAM

Since the publication of Museum Bulletin 47 little attention has been given by the workers at the Entomologic Field Station to the collection and rearing of mayflies. Incidentally, however, a number of new and most interesting forms have been brought together, and nine additional species representing as many additional genera have been reared—mostly by Mr Betten and myself during the summer of 1901 at Ithaca. It is the purpose of this paper to give the results of new life history studies, and also new keys for both adults and nymphs, that shall serve as a better introduction to the study of this interesting group.

That the group is of great economic importance in water culture there can be no doubt. Past food studies have demonstrated this; and every aquatic collector has found the waters teeming with the immature stages. There are mayfly nymphs for every sort of situation in fresh water, and they are almost everywhere abundant. These are perhaps the dominant insect herbivores of fresh water. Notwithstanding their ecological interest, the wonderful ways in which they have adapted themselves to diverse modes of life in different sorts of places, and their singular, though fragile, beauty, their study is very much neglected among us. It is in the hope of interesting more of our field workers in them that I have added to the life histories and descriptions, the keys and text figures of the present paper.

Few life histories of American species, whose nymphs have been positively determined by rearing, have as yet been written. The singular nymph of Baetisca obesa Say has long been

known, having been described by Walsh, its discoverer, and by Vayssiere and Eaton. In bulletin 47 I described the nymphs (having in each case bred the species) of Heptagenia pulchella Walsh, Baetis pygmaea Hagen, Siphlurus alternatus Say, Ephemerella excrucians Walsh, Caenis diminuta Walker, Hexagenia variabilis Eaton, and Ephemera varia Eaton. In the American Naturalist for 1903, pp.25-31 of vol.37, Mr Edward W. Berry described the nymphs of ?Habrophlebia americana Banks, Blasturus cupidus Say and Callibaetis ferruginea Walsh, and in Bulletin 68 I described the nymph of Callibaetis skokiana Needham. That is all the bred species that have hitherto been described in America, so far as I know.

In the following pages I describe the nymphs of the following eight bred species, representing as many genera: Chirotenetes albomanicatus sp. nov. Choroterpes basalis Banks, Leptophlebia praepedita Eaton, Caenis allecta sp. nov., Ameletus ludens sp. nov. Ephemerella bispina sp. nov., Heptagenia interpunctata Say, and Ecdyurus maculipennis Walsh, Mr W. E. Howard furnishing an account of the life history of Polymitarcys albus Say, which he has studied at Ottawa Ill., but which I have not seen at large. I add thereto descriptions of five additional species which have not been bred, but to which the names of native genera are assigned tentatively.

Some of the above descriptions are generic rather than specific: the study of the nymphs in some genera has hardly gotten down to the species as yet. Representatives of all these genera are described and figured in Eaton's *Monograph of Recent Ephemeridae,* at least two of them being tentatively referred to the wrong genera, however. But the excellent and copious figures of that work make it possible to refer the five species of unbred nymphs to their genera with some degree of assurance.

I have published directions for collecting and rearing nymphs of mayflies elsewhere,[1] but while speaking of life histories I would not omit to mention how easy it is to get life-history material in

[1] Part 0 of Bull. 39, U. S. National Museum.

this group. As is well known, there is with mayflies one moult during adult life. The nymph, transforming, leaves the water as a subimago, and later moults again and becomes the imago. The subimago stage lasts but a little while—but a few minutes with the most ephemeral species, about a day with the majority of species, two days with Siphlurus alternatus kept indoors—being much more brief than is the period of transformation of even those species that are most concerted in time of appearance on the wing. It follows from this that when one finds subimagos flying, he can go to the water whence they came and be rather sure of finding, with proper searching, the full-grown nymphs. The subimagos may be recognized by their generally duller coloration, and the possession of fringes of hairs around the wing border (present in the imago of Caenis only among our forms). Grown nymphs may be placed in any sort of a dish of water near a window out of the direct sunlight to transform. The subimagos picked from the window later may be put in paper bags and left to moult again. All stages are best preserved directly in alcohol of about 80 per cent strength.

Besides the material for this paper collected by myself and Mr Betten at Ithaca N. Y. and Lake Forest Ill., and that furnished me from the State Museum collection by Dr Felt, I have received material used herein from Professor T. D. A. Cockerell collected at Pecos New Mexico, from the late Mr R. J. Weith, collected at Elkhart Indiana, from Mr Chauncey Juday, collected at Twin Lakes Colorado, and from Mrs Mary Rogers Miller, collected at Thousand Island Park N. Y., for all of which I return grateful acknowledgment.

For the use of the following keys a little more knowledge of mayfly structure is likely to be required than the average text-book of entomology affords. A knowledge of the names of the parts of the body and legs of the typical insect will be assumed; also, of the principal mouth parts and antennae. It should be known that the male is readily distinguished from the female by the possession of much larger compound eyes, these always being remote from each other in the female, and by the possession of a pair of jointed appendages called forceps that project backward from beneath the penultimate segment of the abdomen. The two

or three filiform appendages which terminate the abdomen are here called caudal setae.

The tarsi are typically five-jointed in the adult, though one or two basal joints show a marked tendency to fuse with the end of the tibia, and the last joint bears two claws of variable form (Fig.5); in the nymph the tarsus is one-jointed and bears a single claw (Plate 6, fig. 7 and 8). The mouth parts in the adult are atrophied and functionless, while in the nymph they are highly developed. But one feature of them needs mention here, however; that is the armature of the mandible. By comparing pl.6, fig.4, and pl.8, fig.6, it will be seen

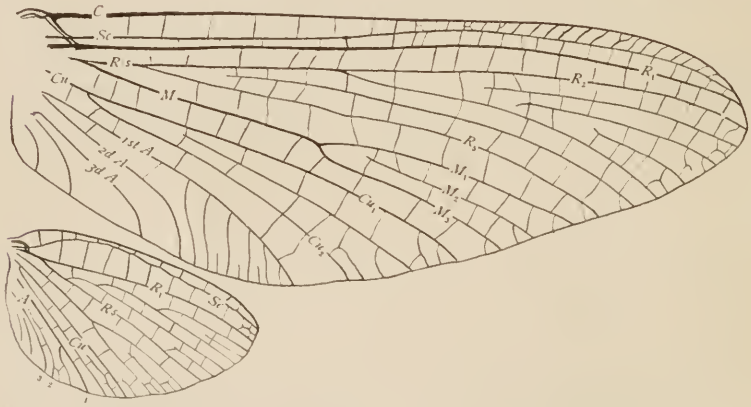


Fig. 1 Venation of the wings of Siphlurus; lettering explained in text

that each mandible bears on its inner side a broad more or less corrugated *molar surface*, and at its antero-lateral angle several variable *canines*.[1]

To the venation of the wings the student who aspires to an acquaintance with mayflies would do well to pay special heed. This is of chief importance because 1) the venation is perfectly definite and easily observed; 2) it suffers least distortion in preserved specimens; 3) it remains the same through the different developmental stages, and 4) the wings are better retained than the other appendages, and progress is better in using a key if the structures mentioned in it have not been lost. The main features

[1]Following the terminology of Vayssiere for these parts. Organisation des larves des Ephémérines: Ann. Sci. Nat. (6) vol.13. 1882.

of the venation are easily learned, and afford a ready clue to the relationships. Eaton says, "Unstable in minutiae, so closely is the essential plan of the neuration adhered to by nearly related mayflies that the general facies of the wing is an important aid to their classification, affording characteristics as easily recognizable as the style of branching in the case of trees."

By reference to figs.1, 2 or 3, or any of the wing figures of the plates, it will be observed that there are three nearly parallel veins extending along the front or costal margin of the wing, costa (*C*), subcosta (*Sc*), and radius (R_1). These three are followed by three forking veins that occupy the greater part of the wing area, the radial sector (*Rs*), the media (*M*) and the cubitus (*Cu*). The middle one of these, the media, forking usually far-

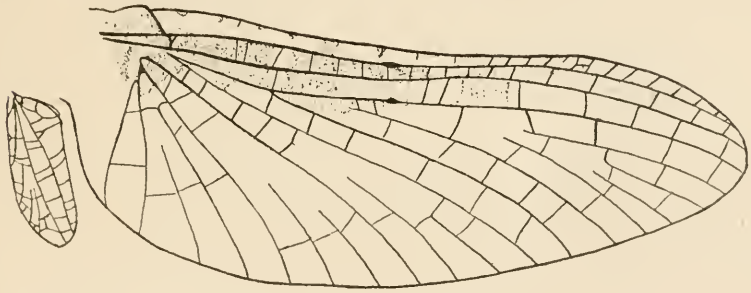


Fig. 2 Wings of Callibaetis

ther outward than the others and being more constant in form, is one of the best landmarks of the wing. All that lies between it and vein R_1 is radial sector, which, in the fore wings of mayflies, is entirely detached from the radius and functions as a separate vein. The only place in the series where there is likely to be any difficulty in recognizing the media is in the few genera closely allied to Baetis (see fig.2) in which both the media and the cubitus are apparently simple; but it will be readily observed by carefully noting the number and relation of the longitudinal veins that the hinder branch of the fork of these two veins is detached, and appears as an independent sector standing on the hinder side; the relative lengths of these veins enable one to recognize them all, even when detached, or when, through shifting of cross veins at their bases, they appear to have formed attachments of a contradictory sort (see vein Cu_2 in pl.8, fig.9). These

three forked veins are followed by three typically simple veins, the first, second and third anal veins, which occupy the smaller area of the hind angle of the wing. There is much variability in this region in the different genera, and it is highly important that these three veins be certainly recognized; to do this it is only necessary to count off the three longitudinal veins of the cubitus—the two branches (Cu_1 and Cu_2) and the bisector of the cubital fork—back of the media, and these three will be the three best developed veins remaining. In the keys the short, inconstant interpolated longitudinal veins are called *intercalaries,* and that whether they become attached to principal veins or branches or remain independent; and the irregular veins about the margin

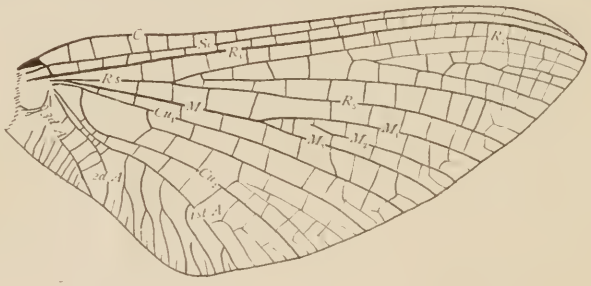


Fig. 3 Venation of the fore wing of Ephemera

of the wing are called veinlets. The length of the media is measured on vein M_2. The fore wing is meant in the key except where the hind wing is specified. Fig.3 shows the unilateral forking of the cubital vein and the divergence of the cubital and first anal veins at base, characteristic of the subfamily Ephemerinae.

KEY TO THE GENERA OF MAYFLIES OF NORTH AMERICA

Imagos

a The cubital and first anal veins strongly divergent at the base (fig.3). Venation never greatly reduced.....**Ephemerinae**

b The fork of the median vein very deep, almost reaching the wing base; two long simple intercalaries between the first and second anal veins. In the hind wing the vein R_5 separates from vein R_1 close beside and therefore is little longer than the next branch of the radial sector.....Campsurus

bb The median vein forked for not more than three fourths of its length; in the hind wing the vein R_5 arises much in advance of other branches of the sector, being much longer than any of them

c Between the first and second anal veins is a bunch of 3–4 long, straight intercalaries, conjoined basally before their attachment to the principal veins; the second anal vein nearly straight and unbranched ..... Polymitarcys

cc Between the first and second anal veins are only shorter, sinuate, and sometimes forking intercalaries, attached directly to the first anal; the second anal vein sinnate and often branched (fig.3)

d The median vein forked ⅔ to ¾ its length; vein Cu_2 not more strongly bent at base than the first anal..... Enthyplocia

dd The fork of the median vein occupying not more than half its length; vein Cu_2 more strongly bent at base than is the first anal (fig.3)

e The third anal vein simple, but attached to the hind margin by a number of crossveins; in the narrow first fork of the median vein there are one or more crossveins before the origin of the vein M_2; male forceps four-jointed

f Caudal setae 3, ♂ and ♀; fore tarsus of female imago ¾ as long as the tibia..... Ephemera

ff Caudal setae 2 in ♂ and 3 in ♀; fore tarsus of ♀ ⅔ as long as the tibia..... Pentagenia

fff Caudal setae 2, ♂ and ♀; fore tarsus of ♀ as long as the tibia ..... Hexagenia

ee The third anal vein with a simple terminal fork and unattached to the hind margin, although a few isolated short intercalaries lie between; in the wider first fork of the median vein there is no crossvein before the origin of vein M_2; male forceps 3-jointed ..... Potamanthus

aa The cubital and first anal veins parallel at base (in a few forms with reduced and scanty venation, appearing a little divergent)

b Eyes of the male simple and remote; hind tarsi with 5 freely movable segments; venation never greatly reduced; intercalary veins between the first and second anal veins unattached basally and in two pairs, of which the pair nearer the hind angle is the longer (pl.4, figs. 3 and 4)..... Heptageninae

c Basal segment of the male fore tarsus not surpassed in length by any of the succeeding segments

d Second segment about as long as the first and longer than the third ..... Epeorus

dd Second segment shorter than the first and about equal to the third ..... Iron

cc Basal segment of the male fore tarsus shorter than some of the succeeding segments

d Basal segment of the male fore tarsus longer than the fifth segment, the second and third segments of unequal length

e The second segment longer than the third..... Ecdyurus

ee The second segment shorter than the third..... Cynigma

dd The basal segment of the male fore tarsus shorter than the fifth segment, and the second and third segments of about equal length

e Basal segment of the male hind tarsus longer than the third segment ..... Rhithrogena

ee Basal segment of the male hind tarsus shorter than the third segment ..... Heptagenia

bb Hind tarsi usually with but four freely movable segments, the basal segment being more or less completely consolidated with the tibia; eyes of the male enlarged, often approximated on the dorsal side and divided into superior and lateral portions with corneal facets of different size; venation various, sometimes greatly reduced; intercalary veins between the first and second anal never as in *b* above ..... Baetinae

c The three anal veins nearly parallel to the hind margin of the wing and to each other, ending in the outer margin; in the hind wing the branches of the radial vein are strongly unilateral on the anterior side ..... Baetisca

cc Anal veins strongly divergent distally, usually both the second and the third ending in the hind margin; forks of the radial vein in the hind wing more symmetrical

d The median vein with a normal fork; hind wings, when present, usually but little longer than broad and with a copious venation

f The intercalaries between the first and second anal veins variable, but usually more or less independent, and not directly dependent from the first anal; three well-developed caudal setae (except in Blasturus, in our fauna)

g Hind wings present

h Vein M_2 and bisector of the cubital fork independent; between the latter and vein Cu_2 no intercalaries; vein Cu_2 in the hind wing rarely preserved; caudal setae generally much longer than the body; penultimate segment of the male forceps shorter than the antepenultimate

i In the hind wing the subcostal vein reaches nearly to the wing apex; male forceps three-jointed

j Hind wing with a slight concavity at the middle of costal margin; 5-6 longitudinal veins between R_2 and R_5; veinlets numerous about the wing margins and crossveins numerous in the hind wings

k Third anal vein of the hind wing wanting; caudal setae of about equal length ..... Leptophlebia

kk Third anal vein of the hind wing present, and often followed by one or two additional intercalaries; median caudal seta distinctly shorter than the others ..... Blasturus

jj Hind wing with an angular lobe projecting forward from the middle of the costal margin; 4 longitudinal veins between R_2 and R_5; wing margins free from veinlets, and few crossveins in hind wing

Habrophlebia

ii In the hind wing the subcostal vein terminates in the costa at hardly more than half the length of the wing, just beyond the obtuse angulation having a thickened margin; forceps of male more or less distinctly four-jointed ..... Choroterpes

hh Vein M_2 and the bisector of the cubital fork both tending to attach themselves to the posterior branch of their respective forks; between the latter and vein Cu_2 are generally some short intercalaries (the cubital region thus being better developed than in group *h*); caudal setae about as long as the body; penultimate segment of the male forceps longer than the antepenultimate

i Veins Cu_2 and 1st *A* separate to base.. Ephmerella

ii Veins Cu_2 and 1st *A* fused toward the base Drunella gen. nov.

gg Hind wings absent..... Caenis

ff The intercalaries between the first and second anal veins represented by a series of veinlets, often sinuous or forking, extending directly from the first anal to the wing margin; costal angulation of hind wing close to the base; but two well-developed caudal setae, the median one being rudimentary or wanting; basal joint of hind tarsi evident but not well developed

g Median caudal seta a distinctly segmented rudiment (pl.6, fig.1); forceps of male three-jointed; posterior prolongation of sternum of ninth segment of abdomen of female bifid at tip

h Basal segment of fore tarsus of male shortest; claws of each tarsus unlike each to each; hind wing with the costal angulation acute, and the fork of the median vein occupying two thirds the length of that vein Coloburus

hh Basal segment of fore tarsus of the male longest; claws of each tarsus alike; hind wing with the costal angulation obtuse, and the median vein forked through one third its length..... Chirotenetes

gg Median caudal seta more rudimentary or wanting; forceps of the male distinctly four-jointed; posterior prolongation of the sternum of the ninth abdominal segment in the female entire at tip

h Claws of each tarsus alike; caudal setae at least one half longer than the body..... Siphlurus

hh Claws of each tarsus unlike; caudal setae about as long as the body in both sexes..... Ameletus

dd Median vein apparently simple, its posterior fork (M_3) being detached and appearing as an intercalary; hind wings when present at least twice as long as wide, and provided with but 1-3 longitudinal veins

e Hind wings present
f Fore wings with numerous costal crossveins before the bulla; hind wings with a moderate number of crossveins
Callibaetis
ff Fore wings without costal crossveins before the bulla; hind wings without crossveins or with but 1-3 of them
g Marginal intercalary veinlets in pairs; hind wings oblong, with a short costal angulation.....Baetis
gg Marginal intercalary veinlets of the fore wing single; hind wings linear, with a spur-like costal angulation
Centroptilum
ee Hind wings absent.....Chloeon

Nymphs

a Mandibles with an external tusk-like ramus, visible from above; gills on abdominal segments 1-7 (often rudimentary on 1), double, flattened, linear, the margins fringed with respiratory filaments
Ephemerinae
b Mandibular tusks longer than the head (burrowing species)
c With no frontal prominence
d Legs increasing in length posteriorly; gills of the first abdominal segment simple; labrum longer than wide; maxillary palpus two-jointed .....Polymitarcys
dd Legs decreasing in length posteriorly; labrum wider than long; maxillary palpus three-jointed.....Euthyplocia
cc With a conspicuous frontal prominence
d Frontal prominence rounded.....Hexagenia
dd Frontal prominence bifid at tip.....Ephemera
bb Mandibular tusks shorter than the head, inconspicuous, only their tips visible from above.....Potamanthus
bbb Unknown .....Campsurus and Pentagenia
aa Mandibles without projecting tusk-like ramus; gills not as in *a*
b Eyes dorsal; body strongly depressed; tarsal claws with lateral teeth; dwellers in rapid streams and on wave beaten shores; adopted to clinging to flat surfaces of rocks, timbers, etc..Heptageninae
c Gills represented on abdominal segment 7 by simple, lanceolate or linear filaments, differing markedly from the lamellae of the preceding segments.....Heptagenia
cc Gills of the seventh abdominal segment lamelliform, like those before them, but smaller
d Gills on all the segments divaricate in pairs.....Ecdyurus
dd Gills of segments 1 and 7 approximated at their tips, being decurved beneath the abdomen, those of segment 1 much enlarged
e Head widest toward the front; mandible with its outer canine linear, truncate and denticulate on the end; labrum retracted far back from the flaring margin of the frons; maxilla with its palpus hairy and the tip of its lacinia armed with three large teeth.....Iron

cc Head widest toward the rear; mandible with its outer canine shaped like a shoemaker's last, the heel pointing laterally and the long, slender, acute toe obliquely forward; labrum pendent from the flaring but notched edge of the frons; maxilla without strong teeth at tip of its lacinia and without long hairs on its palpus.....Rhithrogena

bb Eyes lateral; form of body various; claws smooth or toothed below Baetinae

c Gills completely concealed under an enormously enlarged, four-spined dorsal thoracic shield.....Baetisca

cc Gills exposed; thoracic dorsum normal

d Outer caudal setae fringed on both sides

e Gills on abdominal segments 1-7, double

f Gills filamentous

g Each a pair of simple filaments.....Leptophlebia

gg Each a pair of clusters of slenderer filaments Habrophlebia

ff Gills lamelliform, at least on the middle segments

g Lamellae of each gill similar.....Blasturus

gg Lamellae of each gill markedly differing in form at tip (see pl.8, fig.8).....Choroterpes

ee Gills absent from one or more of segments 1-7; one pair more or less elytroid, covering those behind it

f Gills present on the seventh abdominal segment, elytroid on the third or fourth segment; a pair of tubercles on the apical margin of each segment beside the middorsal line

g Head smooth above.....Ephemerella

gg Head armed above with a pair of erect occipital tubercles Drunella, gen. nov.

ff Gills absent from the seventh abdominal segment, elytroid on the second segment; no dorsal abdominal tubercles Caenis

dd Outer caudal setae fringed only on the inner side

e Posterolateral angles of the hinder abdominal segments prolonged into thin, flat, sharp lateral spines

f Fore legs conspicuously fringed with long hairs; gill tufts present upon the bases of maxillae and front coxae and at bases of lamellae on abdomen.....Chirotenetes

ff Fore legs without conspicuous fringes; no maxillary or coxal gills; no gill tufts at base of lamellae on abdomen

g Gills double on the basal abdominal segments; end of maxilla fringed with simple hairs.....Siphlurus

gg Gill lamellae all single; end of maxilla fringed with pectinated hooks.....Ameletus

ee Posterolateral angles of the hinder abdominal segments hardly more than acute—not prolonged in thin flat lateral spines

f Gill lamellae simple

g Lamellae obtuse at apex; maxillary palpus rounded at the apex .....Baetis

gg Lamellae acute at apex; end of maxillary palpus truncated .....Centroptilum

ff Gill lamellae double, at least on some of the anterior abdominal segments

g Antennae shorter than the body; tracheae of gill lamellae pinnately branched ..... Callibaetis

gg Antennae longer than the body; tracheae of gill lamellae palmately branched ..... Cloeon

eee Unknown ..... Coloburus

In the preparation of the foregoing keys I have used freely Eaton's *Monograph of Recent Ephemeridae,* that great storehouse of information concerning the structure of mayflies. Although in a few minor details I have not been able to accept the classification therein given, I wish to acknowledge my obligation at every turn to its great wealth of illustration, and to express my admiration for the spirit in which its classification is set forth: "It is only by taking cognizance of points of difference and agreement in many details, in the anatomy and the mode of development and the habit of leading representatives of the various alliances of genera, at different periods of their lives, before and after their exclusion from the egg, that the mutual affinities of the several associations of genera to one another can be demonstrated adequately. Until such comparisons can be and shall have been carried out, the whole question of their arrangement can only be dealt with in a tentative and experimental manner; and it will be fortunate if error be avoided in the necessary grouping of the genera into provisional alliances of apparently kindred forms, preparatory to the study of their affinities. It is far more easy to demonstrate defects in proposed methods of classification than to devise a trustworthy system in their stead."

I have correlated nymphal and adult structures, and have expressed that correlation in the foregoing keys, wherein all the major divisions are strictly parallel for the two stages. That this is now possible is a sign of progress toward a natural system of classification. The one serious incongruity in Eaton's system—the interpolation of Jolia in the subfamily Ephemerinae; an incongruity that grew out of a previous error, inherited from Joly—the breeding of Chirotenetes has enabled me to remove. The nymph "Jolia roeseli" is doubtless that of the sole European species of Chirotenetes, Ch. ignotus Walker. A comparison of the figures

of pl.27 of Eaton's Monograph with those of my pl. 5 and 6 will show the close agreement of it with Ch. albomanicatus, and demonstrate its generic position. The adult which Joly furnished Eaton as having been bred from this species of nymph was doubtless a poor specimen of Polymitarcys virgo Oliv. This was suspected by Eaton and yet he allowed the adult to determine the position of the species in his system. Doubtless the nymph Jolia furnished a reason for including Oligoneuria and its allies in the Ephemerinae also. The nymph of Oligoneuria is certainly nearest Chirotenetes of all forms hitherto described; and it has not yet been shown that the very degenerate imagos may not as well have descended from this part of the series, and belong in the Baetinae as here understood. My present ideas of the major natural complexes of the order may be expressed as follows:

1 Subfamily Ephemerinae; a fairly homogeneous series.[1]

2 Subfamily Heptageninae; a very homogeneous series.

3 Subfamily Baetinae; a very heterogeneous series, only definable as lacking the characteristics of the other two, and including five fairly distinct groups, some of which may be found worthy to rank as equivalents of 1 and 2 above:

a) The group of Oligoneuria (Oligoneuria to Homoeoneuria of Eaton; pls. 3 and 26 of his monograph); five genera, represented in tropical America and in the old world

b) The group of Baetis, including all our genera of Baetinae except Baetisca, and many exotic genera

c) The group of Baetisca, including Baetisca only

d) The group of Prosopistoma, including the exotic Prosopistoma only

e) The group of the nameless Chilean nymph figured on pl.53 of Eaton's Monograph

[1]These three subfamilies, which I indicated parenthetically in my key to nymphs published in bulletin 47, I had already recognized in 1897. Shortly afterward my friend Mr C. A. Hart, of the Illinois State Laboratory of Natural History, sent me a manuscript key in which these major divisions were plainly indicated, and also a number of minor divisions, including the tribes Baetini and Caenini of Banks (Trans. Amer. Ent. Soc. 26:247. 1900). This key was then already in use by entomological students at the University of Illinois, the basis for these divisions having been recognized independently and, perhaps, prior to my own recognition of them.

While the breedings of mayflies now to be reported upon are not very numerous, they could hardly be better distributed for the purpose of supplementing existing knowledge. The Chirotenetes life history is the most important, because of the difficulties and discord it clears away. It is well supplemented by the breeding of Ameletus, which shows that to this genus belongs the nymph that Eaton referred by supposition to Chirotenetes (Monograph, pl.40). Furthermore, the other new life histories represent additional genera or very striking species. A few notes are added concerning species whose life histories have been previously known.

The following notes and descriptions follow no systematic order of arrangement, but are ordered as was convenient in writing them:

Baetisca obesa Walsh

This singular mayfly, known hitherto from Rock Island, Illinois and Indiana, the place of its discovery, has been found at two places in New York State: In the Niagara river, by Mr E. P. Van Duzee of Buffalo, and at Newport, where a single nymph was taken May 30, 1902, by Mr D. B. Young and is now in the New York State Museum collection. I have also received specimens from Mr R. J. Weith, taken in the St Joe river at Elkhart, Indiana, but only a few subimagos, however. The rather striking color pattern of the wing of the male subimago (in the imago the wing is wholly hyaline) is well shown in the accompanying figure reproduced from a photograph (pl.4 fig.1). I present on the same plate (fig.2) a new figure of the nymph also. It is absolutely unique among mayfly nymphs. Its huge four-spined carapace is formed by a backward prolongation of the thoracic dorsum. It meets a conspicuous pyramidal elevation on the middle of the abdomen to inclose a respiratory chamber, within which the gills are included. The labium (fig.4) is most inter-

Fig. 4 The nympal labium of Baetisca obesa Say. (The two muscle bands indicated by dotted lines in the basal segment of the left palpus are the same that move the lateral lobe of the dragonfly labium)

esting also, because it offers a transition form to the Odonata. A comparatively slight degree of consolidation of the labial parts here present, and a slightly better development of the two points at the tip of the palpus (of which the last joint is homologous with the movable hook, and the internal prolongation of the preceding joint equals the end hook of the Odonata), would give the grasping labium, so characteristic of the nymphs in that order.

Much has been written concerning the anatomy of this interesting species—especially the anatomy of the nymph. A full bibliography and a new description with some excellent figures are given in Eaton's Monograph, pp.226–229, pl.21 and 42.

Less is known concerning its manner of life. In a general way it may be said to inhabit the more rapid portions of our larger rivers and to be very local. It is rare in collections.

Chirotenetes albomanicatus sp. nov.

The white-gloved howdy[1]

Plates 5 and 6

This is the common Ithaca species, whose nymph is figured on page 87 of Comstock's *Manual for the Study of Insects*. It has been referred hitherto to Ch. s i ɛ c u s Walsh. It differs from Walsh's description of that species in its larger size, later season of appearance, separateness of eyes in male subimago, coloration of front tarsi and of forceps and in conspicuous black transverse apical lines on abdominal segments. It agrees better with Eaton's description and fairly well with his figure of that species, but I doubt whether Eaton had the species of Walsh. Pending the reidentification of Walsh's species, I think that less confusion will result if this one be kept apart under a new name.

This species is abundant in all the rapid streams about Ithaca. I have observed the nymph, especially in those places where the creek bed is flat shelving rock over which the water streams in a thin sheet. In such places the flat, rocky floor of the stream is

[1]Lest it be not discerned, I will state openly that the common name "howdy," which I apply to the members of this genus, is a very free translation into western vernacular of the generic name.

covered with a thin, filmy growth of algae, with abundant nets of the caddisfly seine-maker, Hydropsyche; and the broken edges of the floor ledges are fringed with black masses of black fly larvae, Simulium. Simulium and Hydropsyche are fixed in their places, but Chirotenetes wanders about freely over the ledges, clinging securely even in the swiftest water, keeping of necessity head up stream, moving by short quick dashes, effected by sharp strokes of its powerful tail fin and gill covers, moved synchronously. It is also found in the stiller pools at the sides of the current, in which dwell other mayflies of the genera Caenis and Baetis; and also among the rocks in the current, under which cling other nymphs of Heptagenia, Blasturus and Choroterpes.

Measurements. Length, imago and subimago, ♂ 11-12 mm.; ♀ 12-13.5 mm.; setae additional, subimago, ♂ 13; ♀ 11; imago, ♂ 23; ♀ 20; fore leg of ♂ and ♀ subimago and of ♀ imago two thirds as long as body, of ♂ imago seven eights as long as body.

Subimago. Color brownish tinged, with tawny changing to rufous with age, with a pale middorsal line the entire length of the body dilated and overspreading the dorsum of the mesothorax. Fore legs rufous, with whitish or pale lutescent tarsi, of which the sutures are narrowly marked with brown in the male. Middle and hind legs wholly pale. Wings subhyaline, paler on the inner margin, all crossveins bordered with ashy brown (pl.5, fig.2). Abdominal segments pale brown, the apical margin with a transverse apical line and the lateral margins with a longitudinal dash of darker brown; last segment and setae and appendages wholly pale. The ventral prolongation of the ninth segment in the ♀ is bifid apically as in the imago, but not declined at the tip. The eyes of the male are not contiguous, and the forceps limbs are straight, and surpass the tip of the rudimentary middle seta by the length of the latter.

♂ imago. Thorax brownish, abdomen rufescent; head pale lutescent below, rufescent above between the black-ringed ocelli and the eyes. Thorax darker brown above and below and paler along the sides, but without definite markings. Fore legs bright rufous, with wholly white tarsi; middle and hind legs wholly pale whitish. Wings hyaline. Abdominal segments rufous, transverse apical carinae and lateral margin distinctly lineate with blackish brown; segment 10 paler, yellowish rufescent, strongly produced backward above in a broad obtusely truncated superior

lobe. Along the sides of the abdomen is an interrupted line of black dashes on the lateral margin and there is a minute black dot above the anterior end of each dash on either side of each segment. Setae white, slightly tinged with yellowish on basal segments, but not ringed. Forceps (pl.6, fig.1) long and arcuate, the basal segment of each limb feebly differentiated; coloration pale yellowish white, slightly infuscated in the middle.

♀ imago. (Plate 5, fig.1). Head above whitish or very pale luteous; ocelli ringed with black; a black spot beneath each eye and another at its hind angle above upon a minute triangular backward prominence of the occipital margin. Thorax tawny yellowish brown above, the hind margins of the tergal sclerites narrowly margined with blackish brown; venter deeper brown. Wings and legs colored as in the male. Abdomen brownish rufescent, less rufous than in the male, but with the apical lateral margins more distinctly lineate with blackish brown. Segment 10 pale, produced above into a posterior rounded lobe. Segment 9 produced below in a long acutely bifid lamina, decurved at the apex, and surpassing the level of the tip of the superior lobe on segment 10.

A noteworthy feature of both subimago and imago, hitherto apparently unnoticed in any mayfly, is the persistence of the maxillary and coxal gill tufts of the nymph. These are present as conspicuous blackish tufts on the inner sides of the front coxae and at the sides of the atrophied maxillae. They are most conspicuous (probably because less dessicated) in the subimago, but the constituent filaments, filled with black pigment, are easily recognized in either.

The nymph. (Plate 5, figs. 3 and 4). Length of full grown female 13 mm., antenna 4 mm. and seta 7 mm. additional.

Body rather stout, thorax slightly compressed, abdomen strongly depressed and upcurved posteriorly, its sides parallel as far as the seventh segment, and distinctly wider than head and thorax, then tapering to the base of the stout setae. Integument strongly chitinized.

Head short with vertical face, evenly contoured above, covered at the sides by the low, broad, well-rounded eyes. Middle ocellus directly in front but the other two visible from above. A median frontal vertical carina below the middle ocellus ends in a stout, sharp downwardly directed triangular spine. Antenna (Plate 6, fig.6) stout, naked, basal segment stouter and paler, the shorter segments immediately succeeding brownish, the succeeding segments again pale to the tip. Mouth parts unusually hairy, the

somewhat quadrangular labrum covered above with stout bristles and fringed beyond the bristles around its border with copious soft yellowish hairs (pl.6, fig.2). Labium with two jointed palpi of singular form, the basal joint of each cylindric, naked; the second joint twice as long, flattened, its inner margin straight, its outer margin arcuate, its exterior border closely beset with a single linear series of long thin setae, its apex bearing a minute obtuse inwardly directed prominence, set off by a minute notch from the inner margin, and perhaps representing the remains of a palpal segment (pl.6, fig.3). Galea and lacinia hairy beneath, the latter less than half as large as the former and more triangular in outline. Mandible naked (pl.6, fig.4), the outer canine tridentate at tip, the inner one spine-like, but with a flat margin on one side below overlapping the palp. Maxilla (pl.6, fig.5) with palpus two-jointed and similar in form to the labial palpus; end of lacinia terminating in a long straight spine; a copious tuft of gill filaments takes origin under the base of the stipes.

Thorax strongly arched dorsally and slightly flattened laterally. Legs short and stout, the tibia longest in the fore leg, where one third longer than the femur, decreasing in length successively on middle and hind legs. Fore legs with a remarkable development of stiff fringes of tawny hairs, a single ventral fringe on the femur, a double fringe beneath the tibia, the basal portion containing hairs as long as the combined tibia and tarsus, but the length of the fringe diminishing apically, and a much shorter single fringe beneath the tarsus. There is also on the fore leg a single elongate and flattened tibial spur, more than half as long as the tarsus, and strongly recalling by its [illegible] structure the flat spur on the swimming legs of the diving beetle Cybister (pl.6, fig.7). The single tarsal claw is short and arcuate and denticulate on its inferior margin; on middle and hind tarsi the claw acquires a special convexity on the basal part of its inferior denticulate surface, especially marked in the hind tarsus (pl.6, fig.9). There is a large tuft of several times forked gill filaments attached to the base of the fore coxa within.

Abdomen cylindric at base, becoming depressed and upcurved posteriorly and laterally carinate, the lateral margins on segments 8 and 9 ending in long, straight, sharp lateral spines, half as long as their respective segments. There are minute and inconspicuous lateral spines also on segments 1 to 7, hardly more than acute angles on 1-4. Gills on segments 1-7, covered by obovate protecting lamellae (Plate 6, fig.10), which are slightly oblique, increase slightly in size on segments 1-3 and are equal on 4-7. Each lamella has the front margin, the

base of the hind margin and a diagonal superior carina strongly chitinized. The purplish white-tipped gills are clustered in small flat tufts of 2-3 times branched filaments attached to the bases of the lamellae, and they are shorter than the shortest of the lamellae. Setae stout in basal half, with dense internal fringes of tawny hair. There is a darker band across the middle beyond which the tips are slenderer, and the fringes disappear, the whitish tips being bare.

Color, rich chocolate brown above, paler below and on sutures, a pale median stripe extending upward from the mouth over the head and ending upon the prothorax. Tibiae and tarsi pale with broad median rings of brown.

The fore legs are widest apart and the middle ones most approximate at base.

The dates of my bred specimens are July 12, 14 and 19, 1901. Transformation takes place at the surface of the water as in other species, and the subimago stage continues about 24 hours. On warm nights in midsummer subimagos swarmed into my trap lanterns above Fall creek, Ithaca, but no imagos came to them. Imagos were easily taken along the sides of the gorges anywhere, sitting rigidly, their white fore feet extending full length forward; so they would sit and allow themselves to be picked up with the fingers. This is a fine species, interesting for the agility of the nymph in the water and for the rich coloration and striking attitude of the adult.

Food. With a view to more accurately determining what is the food of this species I had microscopic mounts made of the cleared stomach contents of nine well-grown nymphs from Fall creek. Plant remains constituted in all cases fully half of the stomach contents—in some cases a much greater proportion. There were recognizable remains of numerous Cyanophyceae and other algae, and numerous stalked diatoms of the Gomphonema group (which may have been taken in with the larger plant stems to which they were attached), but the greater part was a brownish mass of remains of the decaying leaves of higher plants. That Simulium larvae had been eaten by four of the nymphs was determined by the presence of isolated rays of the fans. Ecdyurus maculipennis nymphs, common in the stream and of favorable size for the food of this species, had been eaten by at least seven of the speci-

mens examined, as evidenced by the presence of recognizable remains; the claw (fig.11) or the curiously coiled malpighian tubules, or the outer canine of the mandible (fig.13). Nymphs of some species of Caenis had been eaten by four, and a small platode and a very young nymph of Chirotenetes by a single specimen.

Ameletus ludens sp. nov.

The genus Ameletus has not hitherto been known eastward of the Rocky mountains. It is represented in the State Museum collection at Albany by a number of nymphs and two

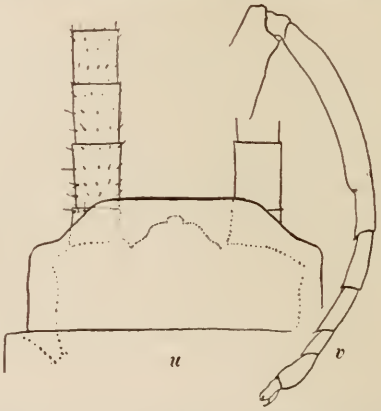


Fig. 5 Ameletus ludens sp. nov., female subimago; u, end of abdomen below, showing truncate apical lobe of the 9th sternum; v, fore tibia and tarsus

bred female subimagos taken by Mr. D. B. Young at Newport, N. Y. on the 22d of May 1902. They were found in the headwaters of a small, swift stream, elevation about 900 feet, in the Hasenclever hills, a spur of the Adirondacks.

Female subimago. Length, 9 mm.; setae, 6 mm. additional; wing, 8 mm. Color obscure brownish, paler on the sutures and below; antennae darker toward the tip; incomplete dark-brownish rings about the ocelli; on the vertex a pair of longitudinal blackish marks, confluent in the middle; a broad median whitish tract upon the mesothorax, produced behind and dilated at the sides; subapical paler bands on the femora, the tips again darker; wings uniformly pale fumose, the venation is shown in pl.8, fig.9; brown marks on the ventral ganglia, becoming more evident posteriorly.

The accompanying text figures will facilitate the recognition of this species when more and better specimens are at hand.

This species is a typical representative of Ameletus, agreeing in close detail with the generic characters set forth in Eaton's Monograph p.210, but it is smaller than any of its congeners. Its nymph is apparently the one figured by Eaton on pl.49 of his Monograph, and referred to Chirotenetes.

The nymph. (Pl.7. fig.1.) Length, 9.5 mm.; antennae, 1 mm., and setae, 4 mm. additional. Body elongate, with vertical face, arched thorax, depressed and tapering abdomen. Antennae short,

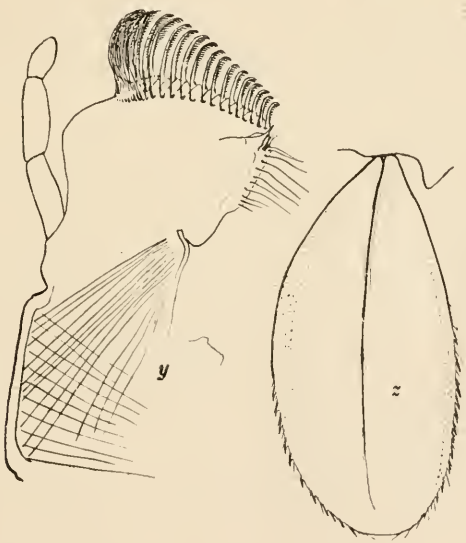


Fig. 6 Parts of nymph of Ameletus ludens sp. nov.; y, maxilla; z, single gill lamella from one of the middle abdominal segments

tapering, bare; ocelli in front; labrum quadrangular, a little longer than wide, emarginate in front, where fringed with fine plumose hairs. Mandibles stout, triangular beyond the molar surface, bearing the canines upon the prominent apex, outer canine more than twice as large as the inner, the latter preceded by a slender subulate spine on the distal margin. Maxilla with a very weak and slender and obscurely three-jointed palpus. The combined lacinia and galea obscurely trapezoidal, the tip of the former indicated by a short, slender and sharp spine, the distal border of the galea fringed densely with a series of strongly arched, regularly gradnated and beautifully pectinated hooks (fig.6*v*). Labium with better developed, three-jointed palpi,

cultriform galeae, fringed with spinules externally, and broadly triangular laciniae, separate to the base.

Prothorax rather short, closely applied to the front of the large mesothorax; wing cases reaching the apex of the second abdominal segment. Legs rather short, stout, pale, with darker lines upon the sutures, the darkest one at the base of the claw.

Abdomen gradually tapering, gracefully upcurving in the rear. Gill laminae on segments 1-7, similar in form on all the segments (fig.6z); smallest on segment 1, largest on segment 6, obovate, with a somewhat thickened front margin, and a longitudinal dorsal chitinous ridge. There are no free gill filaments attached to lamellae. Lateral spines on segments 4-9 straight, sharp, increasing in size posteriorly. Setae rather short and stout, equal, fringed copiously within, traversed by a broad distinct band of brown which occupies their middle third, and slightly washed with brown again at the extreme tips.

This nymph differs from the one figured by Eaton (pl.49, Monograph) in having the middle lobe of the tongue (hypopharynx) bilobed. This genus differs from all others as yet known except Thraulus in the possession of a pectinated fringe on the distal border of the galea of the maxilla.

Choroterpes basalis Banks

This species I have studied in the Fall creek gorge beside the Cornell Insectary at Ithaca. It is a very common species there. The nymph is found among the smaller stones in the side currents of the creek in the bottom of the gorge, associated with other nymphs of Ecdyurus maculipennis, Baetis, Caenis etc. It clambers about under these stones, and when they are lifted out of the water it is easily picked off by hand. The form of the gill tips (Plate 8, fig.8) will instantly distinguish it from all others in the stream.

Imagos were abundant about the middle of July. My bred specimens are dated July 14, 1901. Not many imagos were observed at large except on early afternoons, when the sunshine was warm and bright. Then they would swarm out in the opening of the gorge, and dance high up in the air between the banks of green in myriads. Rising and falling in rapid undulations, moving in large companies up and down the gorge, they rarely descended low enough to bring the lowermost within the reach

of the net; and when by climbing on a big rock in the opening I captured a netfull of them I found they were all males. About the same time also subimagos swarmed into my trap lanterns that overhung Fall creek, and a few imagos with them.

The nymph. (Pl.7, fig.2.) Length, 7 mm.; antennae, 3 mm., and setae, 7.5 mm. additional. Body strongly depressed, widest across the rather prominent mesothorax. Head flattened above; eyes round, prominent, situated just before the hind margin. Antennae situated midway the length of the head, which before them is pilot shaped, dilated at the sides and sharp-edged. Ocelli three, rather large, situated in a nearly straight transverse row in the male, in a triangle in the female. Labrum half as long as broad, widened anteriorly, rounded on the anterior angles and deeply emarginated in front, where fringed with short stiff bristles (pl.8, fig.5). Mandible (pl.8, fig.6) stout, its two canines each tridentate on tip, its palp deeply bifid; on the inner margin just before the molar surface is a low conic tubercle. Maxilla (pl.8, fig.4) short and stout, the palpus two-jointed, the consolidated galea and lacinia squarish, the tip of the former ending in a long and distinctly pectinated spine, the inner and distal margins densely fringed with slender hairs. Labium (pl.8, fig.3) with three jointed palpi, the broad galeae and the narrow laciniae with their tips on a level, and densely fringed with spinules, the spinules on the laciniae being stouter.

Thorax depressed, increasing in width to the bases of the wings. The wing cases reach the base of the fifth abdominal segment. The legs are rather short and stout, with flattened and dilated femora and slender tibiae, pale with a more or less complete brownish ring beyond the middle of the femora and some fainter markings at the knees.

Abdomen depressed, regularly tapering from the third segment to the end, segments slightly increasing in length to the ninth, the tenth somewhat more than half as long as the ninth, produced above in a rounded lobe with a narrow blackish border that is interrupted by paler in the middle of the margin. There are sharp, triangular lateral spines on segments 4-9, increasing in length and sharpness on the succeeding segments, represented on segments 2 and 3 by mere angles of the flat margin, on 8 one fourth as long as the segment. Gills very peculiar; on segment 1 a simple linear or slightly tapering filament (pl.8, fig.7) that is fully as long as the succeeding lamellae; on 2-7 double, lamelliform, with pinnately branching tracheae; each of the pair of lamellae is typically three-lobed; the middle lobe of the uppermost lamella is itself lamelliform, oval or oblong, separated by

marginal notches from the two other lesser lobes (pl.8, fig.8). The middle lobe of the lower lamella is likewise flat, but narrow, linear, and with a better development of the two other lobes at its base. There is a slight decrease in length on segments 2-7; and on 2, and again on 7, the anterior of the three lobes of the upper lamella is scarcely developed. Setae three, fragile, slender, with minute apical whorls of spinules on the segments.

Color olivaceous brown above, with a variable middle pale line, fenestrate upon the dorsum of the abdomen with paler olivaceous. Below, with a broad pale median area.

Several of my nymphs from Fall creek have colonial Vorticellidae attached promiscuously about the dorsum, or aggregated about the bases of the setae.

Pl.8, fig.1, shows the venation and fig.2 of the same plate shows the form of the appendages of the male imago in this species.

Baetis pygmaea Hagen

This dainty little mayfly, which I described in bulletin 47 (pp. 421-423, pl.15, fig.13 and 14), I bred also from nymphs obtained in Fall creek with those of the preceding species, and I took a few specimens of the imagos in trap lanterns hung about the creek during July 1901.

Callibaetis skokiana Needham

I wish to record here concerning this species that I have made a careful examination of microscopic mounts of the stomach contents of ten well-grown nymphs taken from the Gym pond on the campus of Lake Forest College in Illinois, and have found them containing no recognizable animal remains whatever, but only remains of plant tissues, chiefly the disintegrating fragments of the dead leaves of the higher plants, such as litter from the pond bottom, with a scanty sprinkling of algae—Cyanophyceae and stalked diatoms.

Blasturus cupidus Say

I have found his species common in Six Mile creek at Ithaca, where I bred it in 1897. I have apparently identical nymphs in my collection from Elkhart, Indiana, and Raleigh, North Carolina. The imagos of this genus appear in late spring. As before remarked, Berry has described the nymph in the American

Naturalist vol. 37, pp.27-29, 1903. It will be at once distinguished from all other genera by the form of the gill lamellae,

Fig. 7 Gill lamellae of the nymph of Blasturus cupidus Say; e, from the 1st segment; f, from the 4th segment; g, from the 7th segment

a figure of which is herewith given (fig.7). There are well-developed lateral spines present on abdominal segments 8 and 9 only.

Ephemerella

This is one of the genera of Ephemeridae that shows great nymphal specialization independently of adult life. The nymphs are obviously very diverse in form and structure; the imagos very much alike, or else their differences are easily overlooked. Eaton pointed out in his Monograph the remarkable differences between the nymph which I have since bred and shown in bulletin 47 to be that of E. excrucians, and that of the European E. ignita, the only bred species with which he was acquainted. He referred to this nymph as a new unnamed genus allied to Ephemerella; but it is the nymph of the typical species. I describe herein the nymphs of two native species closely allied to E. ignita. I have compared both nymphs and adults with E. excrucians. I have not found differences that would seem to justify the generic separation of the imagos; and notwithstanding the evident differences of the nymphs, I think they may as well, for the present, at least, remain associated together under the one name. The nymphal differences are chiefly in the number and arrangement of the gill lamellae, and these things are perhaps most subject to the influence of environment.

Among the other four North American nymphs described by Eaton are two that will doubtless represent good and distinct genera; and one of these I have been able to identify; for it I erect the new genus Drunella. The structural relations between the American nymphs of the Ephemerella alliance described by Eaton and those I have since obtained may be set forth by means of the following key:

a Antennae inserted in deep angular notches in the front margin of the frons; dorsal hooks of abdomen wanting; nymph from Colorado, imago unknown[1]

aa Antennae inserted upon the upper surface of the frons; dorsal hooks hooks more or less developed in a double row upon the abdomen

b Head armed with high occipital tubercles; hind wings visible at the sides below the fore wings.....Drunella gen. nov.

bb Head smooth above; hind wings visible on the dorsum between the bases of the fore wings

c Gill lamellae present on abdominal segments 3-7

d Front femora strongly tuberculate on inner margin; lateral spines of abdominal segments poorly developed, the abdominal margin not serrate. Eaton's no. I from Washington[2]; imago unknown

dd Front femora smooth on inner margin; lateral spines of abdominal segments strongly developed

e Dorsal hooks of abdomen erect, high, strongly developed Ephemerella bispina sp. nov.

ee Dorsal hooks of abdomen slightly developed, hardly elevated above the surface. Unknown species from New York (p.45)

cc Gill lamellae present on abdominal segments 4-7

d The operculate anterior lamella of the 4th segment covers succeeding lamellae but imperfectly, these successively protruding their whole apical margins. Eaton's no. IV; imago unknown[3]

dd The operculate anterior lamella of the 4th abdominal segment covers closely all succeeding lamellae, only their extreme apical margins visible

e Body hardly more than twice as long as wide; Ephemerella sp? from Pecos N. Mex.

ee Body more than three times as long as wide Ephemerella excrucians

Drunella gen. nov.[4]

I have determined the nymph of this genus by means of the venation of the developing wing. Professor Cockerell sent me two nymphs from Pecos New Mexico, one of which, a male

[1] Eaton no. III. Monograph, p.132, pl.39, 22 figs.

[2] Monograph, p.131, pl.38, figs. 1–10.

[3] Monograph, p.133, pl.40, 17 figs. (Colorado)

[4] To my friend, Professor Theodore Dru Alison Cockerell.

specimen, is in perfect condition for showing the venation. It shows the basal fusion of veins Cu_2 and 1st A that Eaton long since described and figured as characteristic of E p h e m e r e l l a g r a n d i s Etn (Monograph, pl.14, fig.24*b*). This character, together with the rather strong joinings together of the other anal veins basally, readily distinguished this large species from Ephemerella proper. The figures of venation I give herewith (pl.10, figs. 1 and 2) are drawn from the nymphal wing, which shows the venation better than does the single female imago I have seen. I have another identical nymph collected at Twin Lakes Colorado, by Mr Chauncey Juday. Since the type of E. g r a n d i s is from Colorado, it seems very probable that the nymph belongs to this species. In pl.10, figs.3, 4 and 6 I present figures of the male nymph, which differs slightly from the female, figured by Eaton.

Ephemerella bispina sp. nov.

The six specimens of this species that I have seen were sent me in the last lot of material received from the late Mr R. J. Weith. They were collected at Elkhart Indiana, shortly before June 18th—the date on which they reached me at Lake Forest. There were among them single male and female imagos, a male subimago, and three nymphs. The species is apparently near to E. w a l k e r i Eaton from Albany river near Hudson's bay—still so insufficiently known—and to E. i g n i t a Pol. of Europe.

Imago. Length, 9 mm.; wing, 9 mm.; setae of ♀, 10 mm. (of ♂ wanting); of ♂ subimago, 6.5 mm.

Male imago deep brown, varied with olive green. Antennae brown; a whitish ring around their bases. Thorax rich dark brown above and on all carinae, greenish in the sutures and furrows, excepting the median longitudinal furrow. Beside the median prolongation of the hinder lobe of the mesothorax is a pair of acute spines, each decurved at tip and about as long as the space between them is wide. Wings subhyaline; veins pale brownish, as is also the subcostal space. Legs brown, the femora sprinkled with distinct blackish dots; fore leg dark, becoming gradually lighter toward the tip; middle and hind legs paler and tinged with greenish; claws all brown, the obtuse one of each pair darker than the other.

Abdomen pale brown, except the 10th segment which is yellowish, paler on the sutures and thereby appearing ringed; an in-

distinct middorsal row of minute brown longitudinal dashes. Appendages all brown, the inner ones angulated and thickened in the middle and bent upward thereafter to the tip (this appearing only in lateral view; hence not shown in the figure); forceps (pl.10, fig.10) strongly directed downward, the basal segment distinctly differentiated, the apical segment unusually long and slender.

The female imago is greenish yellow, with pale whitish legs and setae. The basal segments of the antennae are brown and there is a pale brownish tinge to the dorsum of the thorax and the lateral margins of the abdomen. Wings hyaline, veins whitish. The ventral apical lobe of the 9th abdominal segment surpasses the tip of the 10th segment and is obtusely rounded apically.

The male subimago is dark greenish brown, darker on the head, the top of the thorax and the apex of the abdomen; the abdominal sutures, however, are distinctly paler. Legs pale yellowish or greenish, the fore tarsus pale brownish. Wings smoky brown. The two dorsal apines are paler in the ♂ subimago and absent in the ♀.

The nymph. Length, 9 mm; seta, 4.5 mm, additional. Body elongated rather slender, depressed, thinly hairy, widest across the mesothorax. Head short; face oblique. Antennae hardly longer than the head, almost bare. Labrum quadrangular, one fourth wider than long, emarginate in front and hairy on the front border, the hairs being longest on the outer angles. Mandibles short and thick, with the outer canine very broad, 3-toothed at apex, the inner canine of equal length but slenderer; molar surface narrow. Maxillary palpus hardly half as long as the lacinia. Third joint of the labial palpus a conic rudiment.

Thorax flat below, well rounded above; legs short and thinly hairy; claws (pl.10, fig.5) with inferior row of about 10 denticles.

Abdomen depressed, its lateral margins serrate by reason of the flat lateral spines in which the side margins of segments 3-9 terminate. There are two rows of dorsal spines on segments 3-8, erect laterally, flattened, almost cultriform. Gill lamellae present on segments 3-7, double; anterior lamina thickened, covering the delicate posterior one, trapezoidal, obtusely pointed at its inner apical angle, palmately veined; posterior lamina shorter, thinner, its margins cut into a small number of fingerlike filaments. The lamellae regularly overlap, each anterior lamina covering the basal fifth of the one behind it, that of segment 7 shorter. Setae closely parallel, slender, fragile, sparingly pilose. Their two proximal articulations faintly ringed with brown. Color olivaceous, with a broad band of brown extending from the rear of the eye to the base of the lateral caudal seta. There is also a narrow middorsal line of brown on the abdomen.

This species differs in the nymphal stage from the nymph next described, chiefly the presence of well-developed dorsal hooks and the absence of black rings on the base of the setae.

Ephemerella unicornis sp. nov.

Along with the six specimens of E. bispina came a single male of another apparently very distinct species, distinguished at a glance from all the others by an erect conic tubercle upon the front margin of the middle lobe of the mesothorax. This species is notably smaller, measuring but 5 mm. in length, with the setae of the same length and the wing hardly longer. The hind wing also is marked with a more distinct basal costal angulation than is common in this genus. The spines beside the backward prolongation of the middle lobe of the mesothorax are present also in this species but apparently not so large. Unfortunately the specimen, although perfect, is a subimago, and the mature coloration can not be given; it will probably be brownish since in the subimago it is greenish as in E. bispina. The abdominal appendages are well enough developed to show that the end segment of the forceps will be much shorter than in E. bispina, while the inner appendages will probably be of the same type as in that species, though probably relatively shorter.

Ephemerella sp?, near ignita

This species occurs at Ithaca, but I have thence but a single nymph. There are two nymphs in the U. S. National Museum labeled "From stream on Mr Chamberlain's farm, Richfield Springs, N. Y., May 13, 1837." It is very closely allied to the European E. ignita, as figured and described by Eaton (Monograph, pl.40; whole figure copied in Cambridge Natural History, vol.5, p.436, fig.282).

One of the two nymphs from Richfield Springs is apparently grown. It measures in length 8 mm., setae, 3.5 mm. additional. Body rather more elongate than in the typical species; eyes laterally prominent; abdomen (pl.10, fig.7) strongly depressed, the usual submedian double row of dorsal tubercles scarcely indicated. Lateral spines, thin, flat, sharp, on segments 4-9, a mere tooth on 4, increasing in size thereafter to segment 8, broader and less sharp on 9. Gills present on segments 4-7, double, on 4 scarcely

operculate, overlapping the next behind it hardly more than that one overlaps its successor. Setae slender, pale, ringed with dark brown at base, thinly hairy except at base (Plate 10, fig.7).

Ephemerella sp?

Professor T. D. A. Cockerell has sent me from Pecos, N. Mex., a single nymph of so remarkable form (Plate 9, fig.2). I desire to make it known herewith. Its affinities are obviously with Ephemerella excrucians, and it differs from all the "allies of Ephemerella" figured by Eaton from western North America. Therefore I briefly characterize it here and present a figure made from a photograph of the single known immature specimen.

Body excessively flat and thin, about twice as long as wide, widest across the middle of the abdomen. Head short and much narrower than the prothorax; eyes and ocelli dorsal, remote; antennae short, bare, about as long as the head is wide, composed of only about twelve segments, of which the basal one is as usual longest and thickest.

All lateral margins very hairy. Prothorax half as long as wide, straight on front and sides with rather acute front angles, somewhat widened posteriorly. Legs short; femora flattened, widest before the middle and fringed on both margins.

Abdomen short, about as wide as long, excessively flat, with huge, serrate lateral spines on segments 2-9, increasing in breadth posteriorly, but longest on the middle segments, all strongly curved posteriorly. Segments slightly increasing in length successively to the 8th, 9 much longer, 10 only about one fifth as long as 9, but slightly produced on the dorsal side. Gills covered by an oblong opercular lamella attached at the apex of segment 4. Of the underlying gills I have made no examination, not wishing to injure the unique specimen. Setae 3, closely parallel at base, broken in the specimen. Coloration very obscure, the animal being apparently covered in life by adherent silt, but there is a trace of a brownish ring on the middle of each tibia and another on each tarsus.

Pecos, New Mexico, July or August 1903.

Professor Cockerell sent me from Pecos also a fine pair of imagos and these may represent the same species as the nymph above described. I should have felt inclined to refer these to Ephemerella inermis Eaton but for the conspicuously bifid prolongation of the 9th abdominal sternum in the female;

this Eaton describes as being entire. Otherwise, there is close agreement. The length is 7 mm. in male, 8 mm. in female; setae; 10 mm. in male, 6-7 mm. in female. The segments of the male fore tarsus in order of diminishing length are 2, 3, 4, 5, 1, the first segment being one fifth as long as the second. The legs are wholly pale. The setae of the male are strongly ringed with black except at the extreme tip in the male, wholly pale in the female. The head and thorax and basal segments of antennae are brown. The abdomen in the male is rufous, paler on the middle segments, and suffused with brownish apically above; in the female abdomen there are broadly triangular transverse basal bands of paler on the middle segments. The posterior prolongation of the sternum of the 9th segment in the female abdomen is deeply divided by a wide U-shaped notch. The abdominal appendages of the male are shown in pl.10, fig.9.

Ephemerella excrucians Walsh

In Bulletin 47 I published a description of the nymph of this species (pp.425-426), bred at Saranac Inn. On June 30, 1901, Mr. J. O. Martin gave me a live nymph which he had just collected from the shore of Cayuga lake, and I reared this also. Since that time I have received a large number of specimens from different places in Indiana, notably from Elkhart, sent me by the late Mr R. J. Weith. From some of the latter, selected to show the great variety in depth of color pattern, I have had a new photographic figure made, which I present herewith (pl.9, fig.1). It will serve immediately for comparison with the very different form of nymph found in the species above described. On pl.10, fig.8 are represented the abdominal appendages of the male imago.

? Caenis allecta, sp. nov.

This is the commonest species in Fall creek at Ithaca. It swarmed into trap lanterns hung about the creek during July. Its nymph lives in the pools and side channels of that turbulent stream, where the water flows gently among small rock fragments over a bottom thinly strewn with silt. Imagos of our smallest species, Caenis hilaris Say, come to the trap lanterns with this one, but in smaller numbers; its nymph I have not found.

Imago. Length, 3.5-4.5 mm.; setae, about 10 mm. additional; expanse of wings, 8 mm.; fore leg of male, 3.5 mm.

General color brown, marked with purplish or slaty gray; head and thorax brown, carinae and margins of ocelli blackish. Wings hyaline, with the usual purplish streak along the radius for two thirds its length. Abdomen pale yellowish brown on base and apex, the middle two thirds washed with gray; some elongate blackish marks on the lateral margins of the 7th to 9th segments; setae white; antennae, femora and forceps yellowish; tibiae and tarsi, except the terminal joint, white. Venation of the wing and the male forceps as shown in the accompanying figures (figs. 8 and 9).

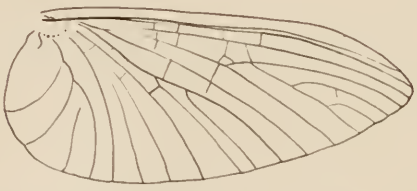


Fig. 8 Venation of wing of ? Caenis allecta sp. nov.

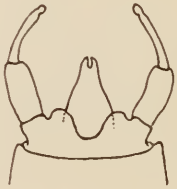


Fig. 9 Ventral view of male abdominal appendages of ? Caenis allecta sp. nov., imago.

Nymph. Length, 2.5-4 mm.; setae, 1.5 ♀ to 2 mm.; ♂ mm. additional.

Color greenish brown, obscure on the head, with a transverse broken and obscure line between the paired ocelli, antennae and legs pale, a pair of brown submedian dots on the prothorax; abdominal segments pale basally and on the sutures; gill covers darker beyond the basal third; segments 8-10 darker with a middorsal pale line on 8 and 9. Lateral spines on segments 3-9, flat and thin, best developed on the middle segments, becoming less divergent posteriorly and losing their lateral fringes of spinules. Setae stout at base, rapidly tapering; middle one distinctly longer in female and shorter in male than the laterals, all with scanty apical circlets of spinules on the segments. Legs scantily and abdomen copiously beset with short hair that is usually covered with adherent silt.

Aside from the not very satisfactory differences of coloration, this nymph differs from that of C. diminuta in having the sides of the prothorax parallel; in diminuta the prothorax is widened anteriorly, and in having a greater part of the abdomen covered by the opercular lamella; in this species that lamella

covers part of the 8th segment; in d i m i n u t a it does not wholly cover the 7th segment.

Were it not that these differences of structure of the nymph are so slight I should have thought a separate genus necessary for this new species; for the differences in venation and in the genitalia are certainly as great as usually serve for generic separation. These principal differences may be tabulated as follows:

Character	Caenis diminuta, hilaris, etc.	C. allecta
Anal veins	disconnected	conjoined basally
Vein M_2	absent	present
Crossveins	uniserial	pluriserial
Forceps of male	one-jointed	three-jointed
Basis	straight edged	bilobed at sides and emarginate in the middle

Among some mayflies that were kindly collected for me by Mrs Mary Rogers Miller at Thousand Island Park, on the St Lawrence river, are a number of typical specimens of our two previously described species, C. d i m i n u t a Walker and C. h i l a r i s Say, that fit the descriptions exactly. In order to promote accuracy in the determination of the most difficult forms, I have prepared the drawings herewith presented (pl.11, figs.3-6) of the wings and male genitalia of these species. It will be observed by comparing the wings with Eaton's figures that in venational characters ? C. a l l e c t a agrees better with the Europaean genus T r i c o r y t h u s and the South American genus L e p t o p h y e s , than with C a e n i s . But there are disagreements also with these, and the ♂ genitalia and nymphs of these are as yet not certainly known.

Leptophlebia praepedita Etn. ?

This species, hitherto known only from New Hampshire and not yet reported from New York State, is common about Lake Forest, Illinois, where I have found it in three quite diverse situations: 1) in the Skokie (north branch of Chicago river), a sluggish creek flowing through open meadows and marshes;

2) McCormick ravine, where a puny stream, overhung with witch-hazel and dogwood, flows between deep banks through a hardwood forest; and 3) in a glacial pothole, grown full of buttonbush (Cephalanthus) on the top of a moraine. In all these situations the water is fairly permanent, disappearing only in seasons of extreme drouth.

The species appears to be diurnal in its habits. Males may be found in abundance sitting on top of the leaves of shrubs beside the water, or flitting over them in the bright sunshine, quickly gathering in companies and dancing up and down, and as quickly dispersing and settling again. They fly at low elevation, and are easily taken in large numbers in a net, and are as easily swept when at rest from the witch-hazel leaves.

I found the species first in the Skokie May 8, 1901. There were then a very few subimagos on the wing, and a bed of mixed ranunculus and polygonum in the water was fairly swarming with the nymphs. I took a large number home and placed them in a bowl of water, where they began transforming the next day. The subimago stage lasts about 24 hours.

When Eaton described the species he had some doubts as to whether it should go in Leptophlebia; but the characters of the nymph are in essential agreement with those of the typical species of Leptophlebia, and thus confirm the reference of the species to that genus. In pl.11, fig.1, is represented the venation, and in fig.2 the ♂ abdominal appendages are shown.

The nymph. Length of body, 6.5 mm.; antennae 2 mm. and setae 6 mm. additional. Body slender, scarcely depressed, widest across the mesothorax, smooth. Face nearly vertical, ocelli in front, eyes rather small situated just before the hind angles of the head; antennae pale, basal segments rather stout, the following ones rather tapering to slender and very fragile tips. Mouth parts very similar to those of Choroterpes, shown on pl.5, the maxillae more oblique on the end of the combined lacinia-galea, and lacking the pectinated spine tipping the former; the palpi, however, are three-jointed beyond the basal palpiger, and the palpi of the labium are two-jointed; thus the conditions of segmentation in these appendages are reversed in the two forms; this segmentation, however, is often very indistinct, and more or less evidence of division of the last segment when there appear to be but two are generally discoverable in all the palpi.

Legs rather short, nearly bare; femora scarcely flattened, but somewhat concave on the side applied to the body; pale brownish, paler at the sutures. Wing cases reaching posteriorly as far as the apex of the 3d abdominal segment.

Abdomen very slightly depressed, regularly tapering posteriorly, its segments very slightly increasing in length to the 9th, the 10th a little shorter on the dorsum, where produced backward in a rounded lobe, one half shorter at the sides; short lateral spines on segments 8 and 9, larger on 9, the lateral angles of the preceding segments obtuse.

Gills present on segments 1-7, double, similar, or slightly longer on the middle segments, divided in nine tenths of their length into two long, slender, simple tapering filaments, pigmented with purplish along the tracheae. Setae 3, equal, nearly bare at base and sparingly whorled with spinules beyond, gradually tapering to long slender tips.

General color olivaceous, paler below, with a very narrow median pale line on head and prothorax, a median row of pale spots on the abdomen of the female becoming larger posteriorly, and a pair of spots either side on segments 3-9, becoming confluent with the median one on 9; male darker and more uniformly brown.

May 8, 27, 30, 31; June 13, 14, 18.

Heptageninae

I deem it necessary to state that I have scarcely entered into the study of this interesting and difficult complex of interrelated forms, having dealt at first hand only with those species in whose life histories I have become interested. The foregoing keys for this group of genera are based largely on characters culled from Eaton's Monograph, and these are but a few of the many characters therein given, and the value of these few as absolute distinctions of closely allied genera I have not personally tested. This group should furnish a most inviting field for some special student, especially here in North America, where it is so abundantly represented.

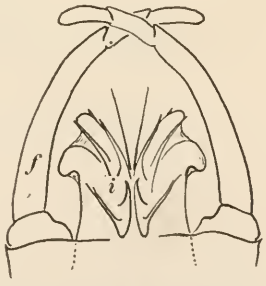


Fig. 10 Ventral view of male abdominal appendages of Ecdyurus maculipennis Walsh, imago; f, forceps; i, inner appendages

In this group the independent specialization of the nymphs is extreme. Their life is relatively long, and the conditions under

which they dwell are very diverse. The conditions of adult life are, however, much the same in all; and we find the adults much more alike. The beginner will certainly find them much more difficult to distinguish, and would do well to study nymphs and adults together. The critical diagnosis of the species will doubtless rest on the highly individualized genital armature of the male. A suggestion of the strength and definiteness of the characters presented by these parts may be had from reference to the accompanying figure of the male forceps and inner appendages of Ecdyurus maculipennis (fig.10). These project strongly from the ventral side of the apex of the abdomen, and are easily separated therefrom in fresh or

Fig. 11 Tarsal claws of nymphs of Heptageninae; w, of Heptagenia interpunctata Say; x, of Rhithrogena elegantula Etn. ?; y, of Iron sp ? from Coy Glen, Ithaca; z, of Ecdyurus maculipennis Walsh; hind claws in each case; middle ones would be similar; front ones sometimes different

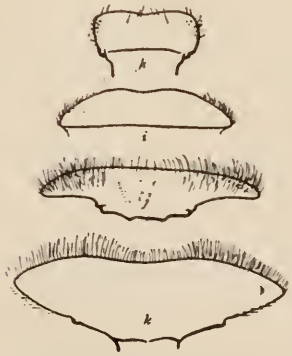


Fig. 12 Labra of nymphs of Heptageninae; h, of Iron sp? from Coy Glen, Ithaca; i, of Rhithrogena elegantula Etn.?; j, of Ecdyurus maculipennis Walsh; k, of Heptagenia interpunctata Say

Fig. 13 Mandibles of nymphs of Heptageninae; c, of Rhithrogena elegantula Etn. ?; d, of Iron sp? from Coy Glen, Ithaca; e, of Ecdyurus maculipennis Walsh; f, of Heptagenia interpunctata Say

alcoholic specimens by a longitudinal snip with a pair of fine scissors. They may then be permanently mounted on a slide as microscopic preparations so as to give a square ventral view. It is from preparations so made that all the figures of the male appendages in this paper have been drawn.

The nymphs in this subfamily are recognizable at a glance by their dorsally placed eyes, with the lateral flaring margins of the sides of the head projecting beneath them. They are all strongly depressed also, and have lateral pectinations to the tarsal claws (fig.11), aiding them doubtless in clinging to their supporting surfaces washed by currents of streams or waves of shores. Further than this, however, there is very great diversity among them, and Ecdyurus, Iron and Rhithrogena, furnish a most interesting illustration of a special adaptation to life in torrents. In Ecdyurus (pl.10, fig.3) the gill lamellae

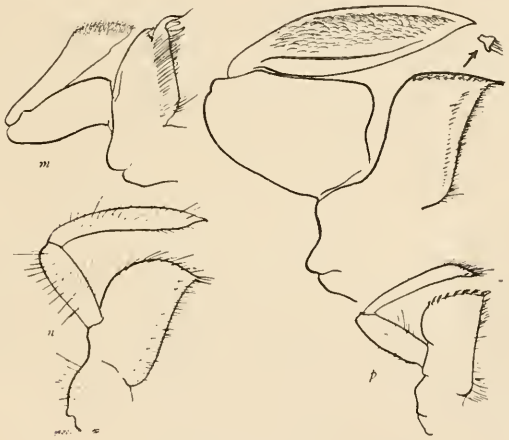


Fig. 14 Maxillae of nymphs of Heptageninae; m, of Iron sp? from Coy Glen, Ithaca; n, of Heptagenia interpunctata Say; o, of Rhithrogena elegantula Etn.?; p, of Ecdyurus maculipennis Walsh

are all divergent and the gill filaments are beneath their bases. In Iron (pl.10, figs.6 and 7) and in Rhithrogena (pl.10, fig.4 and 5) the abdomen is more limpet-shaped, and the gill lamellae form a closely overlapping series whose outer border fits the supporting surface to which the nymph clings as closely as do also the flaring lateral and front margins of the head; but this is not all, the gills have migrated outward and now lie upon the bases of the lamellae, exposed on the outside to the stream of water which now dashes over, but does not flow beneath the lamellae. Furthermore, by the enlargement and approximation beneath the thorax of the foremost lamellae and by the depression and inward curvature beneath the tip of the abdomen of the hindmost of them, there is formed beneath the abdomen a disk for

adhesion to the surfaces of the stones, fairly well developed in Iron, very perfect in Rhithrogena. So complete is its border that when applied to the surface of a stone, any elevation of the abdomen would create a partial vacuum beneath it. It doubtless serves in a different way the same purpose as the row of smaller discs possessed by the larva of the net-winged midge (Blepharocera), found in the same situations; and among anatomical shifts for a living is one of the most remarkable known to me.

The three figures of mouth parts of nymphs of the four genera hereinafter described (figs.12, 13 and 14) show very considerable structural differences. It is because of the remarkable definiteness of such minute parts as the canines of the mandible that I have been able to determine with certainty some of the elements of the food of nymphs of Chirotenetes albomanicatus, its food being all reduced to very minute fragments.

Heptagenia interpunctata Say

This is the commonest species in Fall creek at Ithaca, with E. maculipennis a close second. Both species swarm into trap lanterns set about the creek during July—mostly subimagos just risen from the water. During the daytime imagos are easily found sitting on the vegetation along the sides of the gorge. H. interpunctata is also a common species on the shore of Lake Michigan near my home in Lake Forest, being very abundant along shore in the latter part of August, associated with H. flavipennis Walsh, and a few scattering specimens may be taken as late as September.

The rather well marked color pattern of the wing of this species is shown in the photograph reproduced in Plate 4, fig.4.

The nymphs of this species are found in all the streams about Ithaca in rapid water under large stones. They are distinguishable at a glance from those of all other species by the black markings of the under side, shown in pl.6, fig.3.

The nymph. (Pl.6, fig.3). Length of full grown female nymph, 9.5 mm.; antenna, 2 mm., and setae, 11 mm. additional.

Body strongly depressed, widest across the head, but with the sides behind the head parallel to the middle of the abdomen, thence tapering rather rapidly to the base of the setae.

Head flat, almost orbicularly rounded, limuloid, the inferolateral margins thin, flat, flaring, fringed with decurved hairs. Eyes distinctly dorsal, the lateral margins of the head projecting beneath them. Antennae minute, hardly longer than the head, the basal segments brown and the remainder pale.

Mouth parts as shown in figs. 12h, 13f and 14n.

Prothorax with its declined and flaring lateral margins decurrent upon the sides of the mesothorax; legs short; femora much flattened, and with well-developed posterior fringes of hair; similar fringes on middle and hind tibiae, but scarcely developed of fore tibiae.

Abdomen rather short, strongly depressed, and much tapering beyond the 7th segment; lateral spines on segments 2-9, on 3-5 minute, on 6-9 strong, straight and sharp, longest on 7 and 8, the tip of that on 8 reaching the level of the middle of the 9th segment. Segments of the abdomen diminishing slightly in length to the 7th, the 8th and 9th, then successively a little longer; 10th produced in a rounded posterior lobe.

Gills represented on segments 1-7, on 1-6 double, consisting of an anterior protecting lamina and a posterior basal one, margined with respiratory filaments, whose tips are visible at the inner margin of the lamina. Gill lamella on 1 oblong, somewhat oblique, with a small lobe beside the basal attachment on the side next the median line of the body; on 2-6 similar, becoming somewhat more elongate and less oblique; posterior lamina with its outer two fifths cut into a border of 1-2 branched respiratory filaments. On segment 7 there is a simple linear lanceolate filament (representing the anterior lamina only) whose tip reaches the level of the apex of the 9th abdominal segment.

Setae long, slender and very hairy for more than half their length, the hairs distinctly shorter externally; tips pale, whitish, ringed with darker and nearly destitute of hair.

Coloration olivaceous or greenish brown, darker on head on sides of prothorax and on dorsum of abdominal segments 6 and 10. On the head there is a pale spot before the middle ocellus, another one between each lateral ocellus and the eye, and an oblique pale streak extends from the eye to the margin below it. A pale, narrow middorsal line extends from the rear of the head to the metathorax. The legs are pale, with two broad light-brown bands on each of the femora. On each of the exposed abdominal segments is a transverse pale basal area which includes on each segment, except the 6th, a pair of brownish dots; these dots are elongated into longitudinal dashes on segments 8 and 9. Abdomen beneath conspicuously barred with brown (pl.9, fig.3), one angulated bar on each segment, the bars interrupted in the

middle on both basal and apical segments, but best defined apically.

Bred at Ithaca 18th July, 1901.

Heptagenia sp. no. 3

The nymph of this species was not bred. Like the two preceding it is strongly marked and easily recognized. It occurs in the larger streams, clinging to rocks in the swiftest currents.

The nymph. (Pl.6, fig.4.) Length, 10 mm.; antenna, 3 mm., and setae 13 mm. additional.

Body rather elongate, scarcely wider across the head than across the mesothorax. Head strongly depressed, evenly rounded in front, with flaring infero-lateral margins, dilated at the sides and distinctly visible outside the eyes. Antennae slender, pale. Prothorax slightly narrowed posteriorly, its margins flaring, dilated. Legs moderate, pale; femora with indistinct median and apical darker bands, and with a scanty development of the usual posterior fringes of hair. Wings reaching the level of the base of the 4th abdominal segment.

Abdomen regularly tapering posteriorly. Segments 8-10 slightly diminishing in length, 10 a little produced on the dorsal side, and produced in a sharp triangular spine on each lateral margin; lateral spines developed only on segments 7-9, best developed on 8.

Gills represented on segments 1-7, on 1-6 double, consisting of an anterior protecting lamella and a posterior respiratory lamella whose border is cut into a long fringe of branching gill filaments; upper lamella obliquely oval, produced at the tip into an acute spine-like point, becoming broader distally (obovate) on 4 and 5, and narrower again on 6. On segment 7 there is a simple linear hairy filament, obtuse at the apex and hardly reaching the level of the base of the lateral spine on the 8th segment.

Setae 3, long and hairy, the hairs becoming whorled and finally obsolete toward the tip.

The distinctive features of the color pattern are shown in the photographs reproduced in pl.9, fig.4. These are a broad pale middorsal band divided with brown on the posterior abdominal segments, lateral pale dashes at the sides of the abdominal segments, and a brown longitudinal dash either side of segments 8 and 9 below.

Ecdyurus maculipennis Walsh

As remarked under the account of the Heptagenia interpunctata, this species was found commonly in Fall creek, at Ithaca. Its larvae were more commonly found at the edges of the stream; those of that species oftener in the current, but both often occurred together. This is a dainty little species with narrow wings, conspicuously marked with black on the crossveins (pl.4, fig.3). My bred specimens bear the dates July 9th, 13th and 14th, 1901.

The nymph. (Pl.7, fig.3.) Length, 7 mm.; antennae, 2 mm., and setae, 5 mm. additional.

Body strongly depressed, elongate triangular in outline, widest across the dilated, depressed and squarish frons, and rather regularly tapering posteriorly; head rather flat above; paired ocelli larger and more approximate above in the male than in the female; antennae slender and short. Mouth parts as shown in figs.12j, 13e and 14p.

Legs short, femora flattened, with a thin external fringe of hairs; tibiae slender and somewhat tapering; wing cases reaching the level of the apex of the 3d abdominal segment; abdomen rather short and slender, slowly tapering to the apex, middle segments longest, segments 8 and 9 slightly shorter, 10 again longer on the dorsal side, but shorter at the sides and below; lateral spines present on segments 5-9, longest on 6 and 7, straight and sharp; setae divaricate, the median one in the mature nymph more slender; the apical rings of brown on the segments of the setae are alternately broader and narrower, and the apical whorls of setae are excessively short.

General color pattern olive brown, mottled with pale greenish, darker on head and prothorax, divided by a median narrow pale line, and varied upon the sides with pale hieroglyphics; abdomen with pale and indistinct fenestrate markings along the sides. In the male there are broad dorsal blotches on the dorsum of segments 4 and 5; in the female, on segments 7, 8 and 9.

Iron sp?

This species has not been bred. It is found in Coy Glen—a spring-fed stream near Ithaca, possessing a rich and peculiar fauna. Among our forms hitherto made known this species is peculiar in the possession of but two caudal setae in the nymphal stage. I have a number of nymphs collected years ago, from which, unfortunately, the date label has become detached.

The nymph. (Pl.7, figs.6 and 7.) Length, apparently full grown, 9 mm.; antenna, 1.5 mm., and setae, 9 mm. additional.

Body elongate, strongly depressed, widest across the front of the head and the mesothorax, these being of about equal width; head widest across the front well before the eyes, and strongly narrowed posteriorly to the obtuse hind angles; infero-lateral margins of the head thin and flaring as usual, and closely fringed with hairs; antennae short, slender, pale. Mouth parts as shown in figs.12h, 13d and 14m.

Dorsum of the prothorax a little produced laterally, and angulate obtusely in the middle of the sides. Legs moderate, tibiae and femora all with well developed external fringes of hair; femora very moderately flattened and dilated, the fore femora most so; tarsal claw pectinate, there being two to four minute teeth at its anterior border before the apex (fig.11*y*). The wing cases reach the base of the 4th abdominal segment.

Abdomen regularly tapering posteriorly, its segments increasing in length to the middle. Two lateral spines each side of segments 2-6 and one on segment 7, all stout, triangular, and directed outward.

Gills represented on segments 1-7; on 1 a very large, broadly and obtusely triangular flap of membrane shaped like the gill scoop of a crawfish, attached by the middle of one of the sides, its front end extending forward and lying against the base of the hind leg, its hind end overlapping the succeeding gill lamella. On segments 2-7 the lamellae are ovoid, dorsally carinate, obtusely pointed membranous plates, each with regularly arcuate front margin overlapping the hind margin of the one on the preceding segment, and each bearing at its base a tuft of 7-15 short, finger-like gill filaments. The lamellae diminish in breadth posteriorly, and become less divaricate in pairs, and the tips of the 7th pair are curved beneath the abdomen.

Setae 2, rather short and stout, the median seta being represented by a minute triangular rudiment. The tips of the developing male forceps project beyond the apex to the 10th segment.

This remarkable nymph dwells in the swiftest parts of the stream, and its whole organization exhibits the most wonderful adaptation to life in such a place; the extra grappling armature appended to its claws and especially its flattened form with *thin edges all the way around* closely applicable to the supporting surface, and admirably adapted to divert the flow of the water. Probably the oval enclosure of the gill lamellae of the ventral side of the abdomen acts as a sort of sucker, and holds the animal

securely to the rock surface. The net winged midge Blepharocera is the commonest associate of this species in Coy Glen.

This is another genus that has not hitherto been known eastward of the Rocky mountains.

Rhithrogena elegantula Etn ?

For the sake of illustrating a still more perfect development of the ventral abdominal disk framed with gill lamellae, as well as illustrating the variety of form in this group, I insert here a figure and a brief description of a nymph from Twin Lakes, Colorado, sent me for study by Mr Chauncey Juday, collected in the summer of 1902:

The nymph. (Pl.7, figs.4 and 5.) Length of full grown female nymph, 10 mm.; male, 9 mm.; antennae and setae broken. Body short, stout, flat, narrowly elliptical behind the dilated head; head widest across the eyes, semicircular in outline, its thin lateral margins naked; behind the widest portion the sides converge with very great abruptness to the hind margin; antennae short and stout and bare, the joinings of the segments becoming oblique apically. Mouth parts as shown on figs.12i, 13c and 14o.

Prothorax three to four times as wide as long, produced at the sides in an obtuse projecting angle; legs rather short and nearly bare, the femora moderately curved and flattened with a fringe of rather stiff, very short bristles on the curving superior carina; each of the claws with a basal lateral tooth (fig.11*x*).

Abdomen short and ovate; gill plates on segments 1-7 membranous, white, obtuse, closely superposed at their broadly overlapping edges, bearing copious tufts of long, simple gill filaments at their bases above. The anterior ends of the lamellae of the 1st segment meet beneath the metathorax, and the incurved tips of those of the 7th segment meet beneath the slightly upcurved tip of the abdomen. Setae in male 2, with a rudimentary middle one, in female 3 well-developed, bare, the median paler than the others; extreme bases of setae brown, like the general integument of the body.

Ephemerinae

Since the publication of bulletin 47 I have made no new breedings in this subfamily, but my friend Mr W. E. Howard of Ottawa, Ill., has reared and studied our Polymitarcys albus Say and has prepared at my request the following

account of that interesting species, which differs in some respects from the well-known Polymitarcys virgo Oliv:

Polymitarcys albus Say

BY W. E. HOWARD

This description was undertaken at the request of Prof. Needham, who identified the imago for me. Without his kind assistance in this respect, as well as in many others, it would not have been prepared.

Nymphs of P. albus are abundant in both the Illinois and Fox rivers at Ottawa. These rivers flow at this place over bottoms of solid sandstone, with bars of loose sand accumulated in the eddies. The streams are swift in the main currents, and the nymphs of this species are to be found under flat stones at the edge of swift water when about ready to transform. It was from two such situations that most of my collections were made, from which I succeeded in breeding a single specimen. I have seen the subimagos emerge and arise from the surface of the water in great numbers, but always just far enough out from the shore, so that the nymph skins were immediately swept into the current, where they disappeared before they could be procured. The difficulty in collecting the skins from the natural breeding places is further heightened by the emergence occurring during the evening twilight.

According to my observation, not only this species but all others observed invariably emerge from the nymph skin at the surface of the water and leave the skin afloat. This makes the collecting of the sloughs a much more difficult task than in the case of stoneflies and dragonflies.

My collections indicate that this is a midsummer species in northern Illinois. My bred specimen is dated June 22. None of the imagos in my collections shows an earlier date than this, but I have nymphs which are evidently near to transforming which were collected the first week of June. Imagos and subimagos of the collections are scattered all through July, but August 5th shows them most abundant. At about this date they were observed in swarms. By the end of August they are much less numerous, and I have no collections which are as late as September.

The subimago stage lasts 24 hours, and when the final emergence takes place the subimago alights on some object near the edge of the stream, where it transforms in less than a minute. The skin of the subimago remains attached to the bases of the setae of the imago and in this manner is carried out over the stream by the flying insect, where it is finally released after some minutes.

The adult of this species is briefly described in Eaton's Monograph, p.47. The habitat given there is Passaic river, Belleville, N. J. (Williamson); Winnipeg river (Say); Red river of the north and New York (Hagen). This seems to indicate a rather wide distribution for P. albus in the eastern and northern United States, but during the summer of 1903 I made collections from several of the boulder and limestone streams tributary to the Wabash in Indiana without obtaining a single specimen.

The nymph. Length, 14-16 mm.; antennae, 3.5-4 mm., and setae, 7-8 mm. Body depressed, widest across prothorax where the thin lateral margins project; eyes prominent and lateral; three somewhat crescent-shaped ocelli arranged in the form of a broad-based triangle; antennae many-jointed, bearing a whorl of minute bristles at the apical ends of the joints, the first two joints much stouter and the joints 4-8 decidedly shorter than the others, projecting beyond the mandibular tusks by a little less than half the length of the latter; mandibular tusks about 2.5 mm. long, stout at base, narrowing rather abruptly near the middle, the slender distal half tapering gradually to the acute, slightly out-curved tip; the basal half of tusk is thickly set with stout, acute spines, being less numerous on the slender distal portion, and entirely disappearing at about one third the distance from the tip; a few long hairs are borne on the outer side near the base; mandible stout, bearing two prominent tridentate fangs on its anterior surface nearly parallel with the distal half of the tusk, the middle tooth of each the longest; the endopodite arising from the base of the inner fang is inclined toward the molar surface, and bears a brush of long hairs on its inner side near the tip; the labrum is about half as long as broad, slightly emarginate in front, and thickly covered with fine hairs; maxillae somewhat slender, the outer basal portion fringed with stiff hairs; the maxillary palpi three-jointed besides the short pedicel, the second joint the shortest, the third joint about as long as the first and second together; outer side of third joint bearing a few long hairs, the stoutest ones being near the distal extremity, the

inner side covered with finer ones; the first joint fringed with short, stiff hairs on outer side only; the galea truncate at the tip, which is densely fringed with fine hairs, inner margin with fewer stout hairs, and the inner distal angle bearing a few stout spines; the labium with three-jointed palpi, the large ovate galeae with their tips projecting a little beyond the tips of the small lanceolate laciniae, both galeae and laciniae pilose.

Thorax depressed, widest across prothorax where the pronotum is continued laterally into a wide, thin margin, each margin ending anteriorally with a prominent acute process. The wing pads reach to about the base of the third abdominal segment. The legs are rather long, the foreleg being the longest; the fore femora stand almost at right angles to the long axis of the body, the middle femora at about 45°, and the hind femora closely appressed and nearly parallel with the body; the fore femur bears three or four rows of short spines on its anterior side, and a few stout hairs on its posterior side near the distal extremity; the fore tibia is long, and its inner side, as well as that of the tarsus, bears a fringe of long hairs; the former bears at its inner apical extremity a long, pointed process closely appressed against the inner side of the base of the tarsus; the inner sides of the fore tibia and tarsus both bear a number of small, sharp spines, being the most prominent on the tarsus and the apical process of the tibia.

Abdomen long and gradually tapering from about the third segment, tenth segment about as long as wide. Gills present on segments 1-7, each gill inserted on a lateral prominence bearing a minute tooth just in front of the gill base, the lateral prominence located just in front of the lateral, hinder angle of the segment, directed outward at an angle of about 45° to the long axis of the body; the first pair of gills small, single and spatulate, with minute fringes, are curved upward against the body and are nearly concealed beneath the edges of the wing pads; the other gills are double and shaped somewhat like a tuning-fork, the two branches linear acuminate, about equal in length, the outer branch bearing a rounded prominence at its basal end at the outer side; the respiratory filaments long, linear, about one third the length the gill lamina.

Setae about half the length of the body, plumose throughout the greater part of their length, and then tail-pointed, the median seta not so stout at the base as the others.

Colors of the body chiefly brown, amber on legs and thin margins of the body, an amber stripe along the dorsal median line of the abdomen; a brown band on each femur near the distal extremity, and a small brown blotch near the base of each.

NORTH AMERICAN HYDROPTILIDAE

BY KENNETH J. MORTON, F. E. S. (LONDON)

Some time ago Professor Betten sent to me several tubes containing a large number of examples of Hydroptilidae collected at Ithaca, N. Y. The examination of these has revealed quite an unexpected wealth of species, so many indeed that they should form a very satisfactory basis from which to start on the investigation of the North American forms comprised in this wonderful family. With the approval of Professor Needham and Professor Betten, I have here undertaken the attempt to describe the species found at Ithaca, and further additional material has been received from Illinois (Needham) and from New Mexico (Cockerell). A few specimens from the collection of the late lamented Mr. R. McLachlan, London, have also passed through my hands.

The condition of the material, preserved as it is in alcohol, puts a limitation on the character of the descriptions. The external facies of the perfect insects is practically lost, most of the hairy clothing having been rubbed off. To a great extent, therefore, the descriptions will be confined to the details of the ♂ genitalia, and even with regard to these I may add that much better preparations could have been made from dried specimens. After all the external facies affords very little aid in the determination of the species, although in collecting these insects in a restricted area one learns to know them by their appearance. In the meantime only the males are dealt with. The difficulty of associating with the respective males the true females of say six species of Hydroptila found in the same tube is one that will appeal to any one who has ever made the attempt. Eaton's memoir on the family (Trans. Ent. Soc. Lon., 1873, pp.125-150) was the first which dealt with these minute insect forms after the newer methods. McLachlan in his *Monographic Revision and Synopsis of the Trichoptera of the European Fauna* (London 1874-1880) gives a full general account of the family and good descriptions of the European species which were then known to him. As the best general account existing, McLachlan's work forms the basis for the present paper as regards

genera, etc. Since McLachlan's work appeared, much has been done towards obtaining a better knowledge of the family from different points of view, and our information is now much more detailed and exact with respect to the structure and morphological value of the so-called appendages, this improvement being largely due to the more extended use of microscopical preparations in studying these insects; and something has also been learned concerning the early stages of the lives of these tiny creatures which, as larvae, construct curious habitations of most diverse forms. As contributors to this knowledge may be mentioned the names of Klapálek, Ris, and the writer of the present notice.

Quoting from McLachlan (op. cit. p.503): "The minute insects comprised in this family may be justly termed Micro-Trichoptera, for the largest European form expands to no more than 10 mm., the smallest to only 3½ mm. Where they occur they usually swarm in great numbers, running with extreme rapidity, and very difficult to capture. Although they occasionally appear to delight in warm sunshine, they are more especially crepuscular or even nocturnal, and are attracted by light to such an extent that the walls and ceilings of rooms near water are often dotted with these dark atoms which have entered by open windows."

The largest measurements are attained in Agraylea and Allotrichia, no species of which is here described. The average expanse may be set down as 5-7 mm., the females as a rule being slightly larger than the males in a given locality.

The following table of the genera is taken from McLachlan's *Revision and Synopsis of European Trichoptera*, pp.504-5, with the addition of a new genus which is described on p.72.

A Wings broader, subobtuse, the posterior with no costal elevation or excision. (Neuration tolerably complete; spurs 0, 3, 4; ocelli present and distinct).....Agraylea

B Wings narrower, often acute or subacute; the posterior with a more or less decided costal elevation followed by an excision

a Spurs 0, 3, 4

b Ocelli present and distinct

c Neuration tolerably complete.....Allotrichia

cc Neuration less complete

d Wings scarcely acuminate.....Ithytrichia

dd Wings strongly acuminate.....Oxyethira

bb Ocelli absent (wings acuminate).....Orthotrichia

aa Spurs 0, 2, 4 (ocelli absent; wings scarcely acuminate; head with elevated lobes posteriorly).....Hydroptila
aaa Spurs 1, 2, 4 (ocelli present, wings acuminate, but scarcely acute) .....Stactobia
aaaa Spurs 0, 2, 3 (ocelli present; wings acuminate)..Neotrichia

In ignoring the three species referred to in Hagen's Synopsis, pp.27-45, I have followed a course far from satisfactory to myself, but the only one possible in the circumstances. Whether these species can now be satisfactorily elucidated depends altogether on the condition of the types.

Mr. McLachlan informs me that the Cyllene minutissimella of Chambers proved to be lepidopterous.

Unless otherwise stated the locality is Ithaca, N. Y.

Hydroptila

The genus Hydroptila, as at present constituted, contains many European species, and it is highly probable that the North American forms will prove to be more numerous. A glance at the figures of the appendages will however serve to show that the genus is, in respect of these important parts, far from homogeneous, and it will no doubt sooner or later be split up into two or more genera. The typical form may be taken as that represented by Hydroptila sparsa Curt., the nearest American form being H. consimilis. In this group there is a large somewhat campanulate dorsal plate, regarded by McLachlan as the united superior appendages.

1. Hydroptila consimilis n. sp.

The ♂ appendages as far as they can be described from the available specimens, are as follows: A large dorsal plate, convex above, notched on its outer margin, and the angles of the plate seen from above appear to be acutely produced, viewed from the side they are seen to be rounded. Side pieces of the last segment produced into somewhat curved subacute processes. Inferior appendages nearly parallel, blades slightly outturned at the tip which is pointed and blackened; the inner margin is oblique near the apex; a small wart on the inner margin before the apex; the outer or upper margin bears a row of short spinous hairs. The penis considerably below the apex has a strong curved acute process. Ventral lamina short.

This species, as has been indicated, is close to H. sparsa, but differs from that species in minor details, and particularly in the process on the penis, this process in H. sparsa being smaller and nearer the tip of the organ.

Ithaca, N. Y., and Belfrage, Texas.

2. Hydroptila delineatus n. sp.

This species has the lobes on the head enormously developed. The antennæ are about 31-jointed in the ♂.

The last dorsal segment appears to be deeply excised, the excision being followed by a large semitransparent plate difficult to separate from the basal portion of the appendages, but apparently having a small submarginal projection on either side of a larger median one, but the outline of the plate is rather uncertain. The inferior appendages are nearly parallel, the apex outturned and upturned; the apical portion seen from the side has the lower angle somewhat produced while the upper part of the apex forms a kind of knob which in some positions shows a slight angle on its anterior side. Arising from the upper side of these appendages is a long spirally curved acute process which winds itself round the under side of the apical lobe. On the outer (or lower) edge of the appendages, near their middle, is a slightly raised part bearing two or three spinous hairs. Ventral lamina short.

This species can be determined without difficulty from the ventral aspect of the appendages. It has no very near known ally.

3. Hydroptila spatulata n. sp.

The dorsal plate in the ♂ narrower than in consimilis, deeply notched in the posterior margin. Inferior appendages approximated at the base, slightly curved outwards and downwards, superior edge with a few spines; apex apparently scabrous. Side pieces of the last segment produced into rather long subacute processes. The penis, usually much exserted, with a flattened rounded apex, immediately below which is a small acute process placed at right angles. Ventral lamina very long and slender, slightly swollen at the apex when viewed from the side, the outer margin obliquely truncate, blackish and roughened. No very near ally known to me.

4. Hydroptila hamata n. sp.

The dorsal plate in the male is small, broadest in the middle, apex excised. Beneath it there is a small rounded penis-cover. The appendages are narrow, finger-shaped, aristate and widely divergent. Two strong hooks visible at the posterior margin of the last ventral plate or segment. The penis is very slender, curved at the apex and accompanied by a slender sheath of equal length. Ventral lamina very long; in lateral outline somewhat club-shaped, but lower margins oblique and minutely serrate.

This species is certainly near to the European femoralis, but it differs especially in the form of the dorsal plate which in femoralis is not notched and is boat-shaped in outline.

5. Hydroptila perdita n. sp.

Antennæ about 31-jointed in the ♂. The dorsal plate is large, rounded posteriorly, gradually becoming wider, the margins slightly retracted at the base, a small hollow looking patch near the apex. The inferior appendages subparallel blades, twisted outwards at the apex, which is obscurely bifid; scattered spinous hairs, particularly on external (superior) margin. Penis broad towards the base; in the exserted part tapering to a point, below which is a very strong curved acute process standing out strongly from the stem. Ventral lamina small.

ITHYTRICHIA

The typical forms of this genus are rather robust-looking insects bearing considerable resemblance to the species of Hydroptila, but they are at once distinguishable on account of their distinct ocelli and the absence of the elevated lobes on the posterior part of the head.

6. Ithytrichia clavata n. sp.

In the ♂ the antennae are about 24-jointed. The appendages may be described as follows: There appears to be a transparent dorsal plate with outer margin nearly semicircular in outline, but the plate is very difficult to separate from the other parts. There are very large side pieces of subtriangular form in the lateral aspect, blade-like if viewed from above, the apex down-turned and outturned rather acute and blackened at the extreme

tip. What may be termed the inferior appendages are not distinctly separated from the side pieces, and consist of a ventral plate apparently deeply slit; seen from the side the separate divisions of the plate appear as a rather long appendage slightly upturned and blackened at the point. The penis is club-shaped at the apex in one aspect; in another it is slightly excised at the apical margin and the club is hollow with a slender rod-like process lying within it. The penis seems to be formed of two joints, the apical probably capable of being partly retracted within the other; the latter joint is broad at the proximal part, but becomes constricted before the apex; a spiral sheath arises from about the middle of the organ. Beneath the penis is a transparent process out of which proceed two or more spines, and on either side of this central process are sometimes visible two minor ones.

There is some uncertainty about the form of the dorsal plate, but the true form of this will be readily ascertained from preparations made from fresh or dried specimens. Equally there is uncertainty about the cleavage of the ventral plate. These transparent membranous plates appear to suffer in form from immersion in alcohol.

A species closely allied to I. lamellaris of Europe, of whose appendages no adequate figures have so far, been published. In I. lamellaris in the part corresponding to that which is called above "inferior appendages" there is, I believe, no slit, although a long, narrow part where the membrane is thinner sometimes gives an illusory idea of a slit. In lamellaris the dorsal plate is produced in the centre with a blunt, slightly rounded lobe, while the process underneath the penis is about equal in breadth to the above-mentioned lobe, and instead of being simple as in clavata it is subdivided by an excision.

The larva referred to in *Psyche*, vol. ix, pp.375-8, is almost certainly that of the species just described. Whether the views expressed in that paper are well founded or not can only be determined by a more complete knowledge of the life history of the creature, the working out of which should be sufficiently attractive even if it does not result in the verification of Professor Needham's views.

The larva of Ithytrichia was originally discovered by a Mr Bolton of Birmingham who formerly supplied living microscopical material for students, and it was noticed by me in Ent. Mon. Mag., 1st series, vol. xxiv, p.171 (1888); it has also recently been described by Ulmer (Stett. Entomol. Zeit. 1902, p.364).

7. Ithytrichia confusa, n. sp.

Antennae about 28-jointed in the ♂, long and slender, none of the joints really submoniliform, entirely fuscous, save a few basal joints, which are pale yellow.

The last segment is open dorsally and within it lies a complicated organ represented in fig. 16. The appendages are closely approximated ventrally; in the side aspect they consist of a broad basal part, from the upper portion of which springs a long blade-like process, with rounded outer margin, beset within with numerous spines or spinous hairs. The outer margin of the basal part is beset with strong incurved teeth.

This species, which is very easy of identification, is referred provisionally to Ithytrichia, but the form of the appendages and the long slender antennae isolate it from the typical species of Ithytrichia. It is almost certain to be ultimately regarded as the type of a new genus.

Orthotrichia

The European species frequent both standing waters and rivers. They are insects which measure from 6-8 mm. in expanse of wing, and McLachlan says of O. angustella that its antennæ have about 39 joints in the ♂ and about 31 in the ♀. The most prominent features in the ♂ genitalia are as follows: Large dorsal plate which is more or less asymmetrical, usually notched in its outer margin and with stronger chitinized parts, which assume the form of hooks or strong teeth. The penis is of very great length, very slender, apparently divided into two parts, the apical part which probably forms about $\frac{1}{5}$ of the whole, being probably retractile (according to McLachlan, and I think he is correct). In Orthotrichia tetensii Kolbe, the side pieces of the last segment are asymmetrical, on one side being produced into a rather long, slightly curved sub-acute process, the other

into quite a short process, while the inferior appendages are much incurved, also asymmetrical, one of the appendages having a large ante-apical swelling or blunt tooth. In Orthotrichia angustella McL. the side pieces are apparently on much the same plan, but the appendages are strongly divergent.

8. Orthotrichia brachiata, n. sp.

Although but one poor specimen existed in the collection, I have no hesitation in referring this to the genus Orthtrichia on its general characters. As a species it is critically near O. angustella and the two are almost certainly representative of each other on the two continents. In O. brachiata the side pieces appear to be asymmetrical, but the specimen is somewhat damaged in this respect. The penis is typical of the genus and is notched at the apex. Alongside of it is a very strong acute sheath and under it a cover with rounded apex. The inferior appendages are very strongly divergent, aristate. Above these (according to what is found in O. angustella) there should be two spiniform processes slightly divergent and terminating in a hair, but in the specimen before me these can not be made out satisfactorily. The margin of the last ventral segment has a small chitinized median plate broader anteriorly and with excised fore and hind margins, the posterior projections each bearing a short bristle. The dorsal plate is as usual unequal on its two sides, but I can see no trace of teeth, although portions of the margin are more or less strongly chitinized.

It is to be regretted that the material is so unsatisfactory, but the figures should serve for identification.

Oxyethira

This genus, conspicuous on account of its narrow wings, has proved one of the most prolific of species in the European fauna. No estimates can be placed on the number of species that may eventually be found in North America; the possibilities are boundless.

9. Oxyethira coercens, n. sp.

Antennæ in the ♂ about 31-jointed.

The last segment dorsally is semicircularly excised when viewed from above; seen from the side the edges are strongly

toothed. The ventral plate, if viewed from the side, is in the form of a strong claw with serrate margin; from beneath, its margin is excised rather deeply, and each of the side lobes has about three teeth. On either side the apex of a blackish rod is usually visible. The penis has the apex much dilated and armed with two or three teeth.

This species, which belongs to the same group as the European O. frici Klap., should be very easily recognized from the ventral plate.

10. Oxyethira viminalis, n. sp.

The margin of the last dorsal segment is slightly and simply excised. Beneath, the margins of the segment recede and form a deep excision. The ventral plate has the margin nearly straight, and above it are two blackish appendages—no doubt the homologues of the hooks which lie above the ventral plate in several European forms. The penis is large, and with its sheaths forms a very complicate structure; the apex, however, is simple. The only other appendages visible are a pair of lateral rods.

Described with great hesitation from a single ♂ from Ithaca, but afterwards fully verified from further material from Prof. Needham (Lake Forest, 15 Oct. 1902).

11. Oxyethira dualis

In this species the appendages are very simple; seen from above the penultimate segment is deeply excised; from the same point of view is visible a quadrate penis cover, the posterior margin of which has two slight excisions. From beneath is seen the simple ventral plate, almost straight in its posterior outline, the hind angles slightly oblique; the plate is rather broader at its base and on each lateral margin is a faint angle. The apex of the penis has an elongate swollen part, probably exaggerated in figs. 37 and 38, through the presence of some extraneous matter; after preparation this part had the appearance of having two slightly chitinized straight rods and a sickle-shaped one.

1 ♂ Las Vegas, New Mexico. (Cockerell.)

Another larger female, probably also an Oxyethira, was in the sending from New Mexico, but I can say nothing definite about it in the absence of the ♂.

NEOTRICHIA, NOV. GEN.

Spurs 0, 2, 3. Ocelli present. Head posteriorly with two large pyriform warts; disc elevated with a median longitudinal line. Antennæ with 18-19 joints (probably in both sexes), joints shorter and more submoniliform in the ♀; rather stout, basal joint moderately long and slightly curved, second joint somewhat shorter, the four following subequal and cylindrical, the remainder submoniliform. (Palpi uncertain from the material in hand.) Legs long and slender. Neuration apparently simpler than in any of the other known genera. (Compare the figures.)

12. Neotrichia collata n. sp.

In the ♂ the apex of the abdomen may be described as follows: Above there is a semitransparent transverse plate, at either side of which are two rather longer thin processes which seem to be slightly out-turned at the apex. There are also semitransparent side pieces rather slender and slightly curved. The inferior appendages consist of two parallel contiguous processes which at the apex on their inner edges are obliquely truncate and bear one or two teeth. The penis in its apical portion consists of two closely-lying parts of nearly equal length, slightly hooked at the tips.

A minute and exceedingly interesting form. The figures were rather difficult to obtain from the material received, but the important characters are set forth and will serve sufficiently for identification.

From New Mexico a large number of interesting cases belonging to two or probably three species have been sent. One is a veritable Oxyethira, while the others belong probably to Hydroptila, but I am not sure whether the differences shown by some of the cases are due to individual variation or point to the presence of two species.

SUPPLEMENTARY NOTE

In the interval that has elapsed since the above paper was written, Mr. Nathan Banks has published two papers which contain references to North American Hydroptilidae (two species of Hydroptilidæ, Ent. News, April '04, p.116; and A List of Neuropteroid insects, exclusive of Odonata, from the vicinity of Washington, D. C., Proc. Ent. Soc. Wash. Vol. vi. No. 4, pp.215-6). These may give rise to questions of synonymy, but at

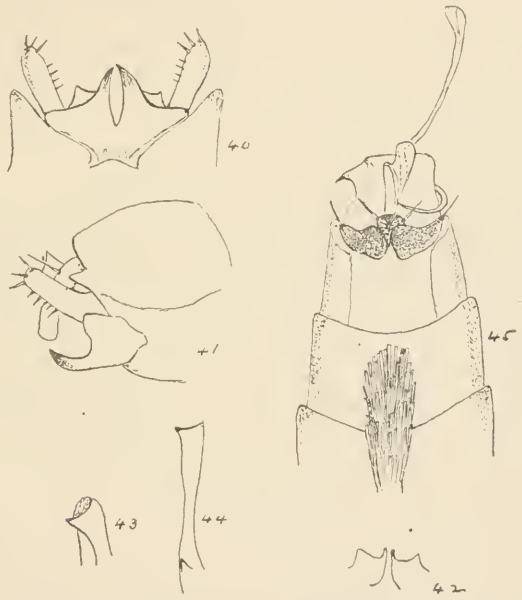


Fig. 15 Hydroptilid structures: Agraylea multipunctata; 40, apex of abdomen from beneath, 41, same from side, 42, triangular pieces from side, 43, same when much exserted, 44, ventral lamina; Orthotrichia americana (?) 45, apex of abdomen from beneath.

the moment I am unable to deal with the subject which I think may be safely left to be cleared up by American students.

In the same interval some further material has come to hand from Professor Needham and Professor Betten, but this has been only partially examined. It includes an Agraylea which appears to be the same as the European A. multipunctata, and an Orthotrichia which I had described under the name of O. cristata but which may be O. americana, Banks. There is also another good species of Hydroptila, but the material is hardly sufficient for description.

Professor Needham bred the Agraylea and sent me the larva and cases. The metamorphoses of Agraylea and many other European forms have been described recently in an admirable way by Herr A. J. Silfvenius of Helsingfors.

Agraylea multipunctata Curt.

McLachlan, Rev. & Synopsis, p.506, describes the species as follows:

Antennæ blackish fuscous. Body blackish fuscous; abdomen greenish in life; blackish in dry examples with pale lateral lines; the ventral surface clothed with silky yellowish hairs. Head and pronotum clothed with greyish yellow hairs. Legs subtestaceous with fuscous femora; clothed with pale hairs. Anterior wings ordinarily blackish, with numerous distinct golden-yellow markings, mostly forming spots, but usually there is also a long and broad space near the apex of the costal margin, about two elongate spaces on the inner margin, and two or three apical spots extending into the fringes which are otherwise dark (but these markings are very variable; individuals occur in which they are entirely absent, the wings then being wholly blackish, or in which they invade the whole wing, obliterating the dark ground and causing the insect to appear pale cinereous). Posterior wings cinereous grey, with concolorous, slightly iridescent fringes.

In the ♂ there appears to be a bilobed shining yellowish plate under the margin of the last dorsal segment. Superior (intermediate?) appendages in the form of two contiguous yellowish bands, very strongly curved downwards; from between them escapes the penis, which is dark, straight, updirected, its apex dilated and truncate. Inferior appendages, viewed ventrally, very distant, upcurved, yellowish, subcylindrical, but they are apparently connected with two upcurved contiguous median processes, seen from the middle of the ventral margin, more slender than the appendages and blackish at the tips; internally, on either side of these, is a triangular piece. Lobe of the antepenultimate ventral segment long, *flattened and adpressed dilated gradually to the apex*, which is shallowly excised and narrowly blackish; the colour otherwise testaceous; at the base of this lobe is a subtriangular blunt tooth.

In the ♀ the abdomen ends in a stout upcurved ovipositor, and there is the usual small sharp tooth on the antepenultimate ventral segment.

Expanse 7½-9 mm.

The foregoing description was made no doubt entirely from dry examples. The words italicized and the stouter form of the inferior appendages are almost the only characters which served to separate the closely allied A. c o g n a t e l l a, a very critical species regarding which I have some doubt.

The superior (intermediate?) appendages of McLachlan, described by him as in the form of two contiguous yellowish bands very strongly curved downward, appear to be separate at the base only, the downturned tip being rounded. Between the divided base escapes the penis, which is not shown in the figures here. The construction of the socalled triangular pieces is very peculiar and their appearance depends much on the degree to which they are exserted.

The North American insect is practically identical with the European; the only difference appears to be in the upcurved contiguous median processes which are probably rather shorter and stouter in the American form. The latter was bred by Needham at Lake Forest in June, and he sent the same species from Chicopee Mass. (23 April '03). It will probably prove to be common in the Northern States.

Orthotrichia americana Banks ? (Ent. News 1904, p.116)

O. cristata Morton, U. S.

The dorsal plate in the ♂ is almost entire in its outer edge; from the one side, on the upper surface, arises a short hook, while on the other side, nearer the middle, arises a long, slender, much-curved acute process bent strongly inwards under the plate itself. The last ventral segment terminates in two separate blackish plates which are broadest where they approach each other, narrowing outwards, their apices bearing a spine; between these plates is a black appendage which seen from the side is hook-shaped and bears two spines. The seventh ventral segment with a process covered with strong thick blunt hairs; the sixth segment with a small tooth.

Lake Forest, Ill. (Needham).

The process on the seventh ventral segment is very similar to that found in the European O. t e t e n s i i.

AQUATIC NEMATOCEROUS DIPTERA II

Chironomidae

BY OSKAR AUGUSTUS JOHANNSEN

The present work forms a continuation of the paper entitled "Aquatic Nematocerous Diptera," published in bulletin 68 of the New York State Museum (1903). In that paper the Blepharoceridae, Simuliidae, Culicidae, and the Dixidae were treated. In this paper the Chironomidae will be considered, the classification reviewed, the chironomid genera of the world described and discussed, and finally descriptions given of the imagoes of all known North American species except those belonging to the group Ceratopogon (sens. lat.). Descriptions will also be given of all larvae and pupae as far as known. The bulk of the material studied was collected in New York, but many specimens were obtained from the Mississippi valley, Rocky mountain and Pacific coast states. In drawing up the descriptions of the species upward of 5000 pinned specimens and much alcoholic material was studied. In order to save space the references to works of authors are abbreviated, only the author's name followed by a date is given, the complete reference being given in the bibliography in the back of the book. The study upon this family of flies was begun in the spring of 1901 and was continued throughout four seasons. The work was done in the entomological laboratory of Cornell university under the direction of Professor J. H. Comstock, to whom I wish to express my thanks for advice in the preparation of this work. I am also under obligations to Professor Kellogg of Leland Stanford jr. university, Professor C. O. Houghton of Delaware agricultural college, Professor Aldrich of Idaho, Mr. A. L. Melander of Washington State, and Doctors MacGillivray and Riley of the instructing staff of Cornell university; and especially to Professor J. G. Needham of Lake Forest university for specimens and many favors.

The family of the Chironomidae or midges comprises a large number of very delicate, and often minute flies, of which over 800 species are known throughout the world. They resemble mosquitoes in some respects, but are usually more delicate, and

may be distinguished from them by their wing venation. These midges are often seen, especially in early spring or autumn, in immense swarms dancing in the air, and are frequently to be found at these seasons upon the windows of dwellings where they are often, perhaps usually, mistaken for mosquitoes.

Professor Williston relates (1896) that over meadows in the Rocky mountains he has seen them rise at nightfall in most incredible numbers, producing a humming noise like that of a distant waterfall, and audible for a considerable distance. Most of the species are inoffensive or actually beneficial as scavengers. The group Ceratopogon, however, forms an exception, some members of which, known as sandflies, or punkies, have the power of sucking blood, and are particularly troublesome in the mountains, along streams, and at the seashore. The Chironomidae are very widely distributed, being apparently as prevalent and as numerous in the frigid as in the torrid zone. There are about 500 European species, many of which were described by Zetterstedt, from Sweden and Lapland. Of the species hitherto described from North America over one third are from Alaska, Greenland and Hudson bay territory. A surprisingly large number of species are common to both Europe and North America. When the fauna of Asia, Africa and South America is as well known the total number of species will doubtless be increased many fold.

Geological distribution

One would scarcely expect the delicate, minute flies of this family to be preserved from mesozoic times, yet they seem to be not altogether unknown. Two species referred to Macropeza are figured, one by Geinitz from the Lias of Dobbertin and one by Brodie from the English Purbecks; two other obscure forms from the English Purbecks are figured under the name of Chironomus; and Corethrium pertinax and Cecidomium grandaevum of Westwood, from the same beds, appear to belong to this family rather than to the Cecidomyiidae or Culicidae. Rhyphus priscus Brodie, from the English Purbecks, also probably belongs here and not to the Rhyphidae.

The family is very abundant in amber, Loew having found seven species of Tanypus, more than forty of Chironomus and twenty-six of Ceratopogon. Giebel also describes two species of Chironomus and one of Ceratopogon in amber, and these genera had previously been recognized as occurring there by Burmeister, Erickson and others. Duisberg also records a peculiar genus, Sendelia, from the same. But the occurrence of the family in a fossil state is not confined to amber; thirteen species of Chironomus have been described from Rott, Oeningen, Rodoboj, and Utah, and the genus has been recognized also in Wyoming, while numerous pupae distinguishable as belonging to several species are recorded by Heyden from Rott. Ceratopogon has also a species at Rott, and it has been recognized at Aix and in Sicilian amber. Numerous specimens of the family occur at Florissant, but they are usually in very poor condition; they have also occurred in the British Columbian tertiaries. Scudder (1886).

Economic importance

The only function of the imago of the Chiromomid, at least in the group Chironomus, and perhaps Tanypus also, is that of reproduction. Miall and Hammond (1900) say, "It is evident that Chironomus does not feed in the winged state. The mouth parts, though of elaborate structure, are never used in feeding, and the alimentary canal of the fly is empty, except for a greenish fluid, which fills the stomach of the pupa and newly hatched fly. . . . The larvae of Chironomus feed on dead leaves and other vegetable refuse. Microscopic examination of the contents of the stomach reveals a blackish mass of vegetable fragments, besides Diatoms, Infusoria, eggs of other aquatic animals and grains of sand."

Some species of the group Ceratopogon are blood suckers and their mouth parts as figured by Professor Kellogg (1899) seem admirably adapted to this function.

The larvae and pupae of the Chironomidae are of much importance as fish-food. Professor Needham (1903, p.204) mentions the fact that large numbers of the larvae of a species of Chironomus were taken from the stomachs of brook trout,

proving that these fish live almost exclusively upon "bloodworms," at certain seasons at least. Garman (1888) says: "Probably no other one genus of insect constitutes as important an item in the food of as large a number of fishes." While Forbes (1877) in giving a list of the organisms which form food of fishes records Chironomidae as occurring in the stomachs of many species.

Enemies

Besides the fish which devour vast numbers of Chironomid larvae, the nymphs of dragonflies, caddis worms, Perla, Sialis, beetle and other predaceous larvae constantly prey upon them; while the adults are eaten by dragonflies, by the net-winged midges (Blepharoceridae) and other predaceous insects. In a swarm of these midges very often one also sees a number of danceflies (Empids) constantly seeking victims.

Methods of capturing, rearing and mounting

Sweeping the low brush, rank grass, and herbage along the banks of ponds and streams is the usual way of capturing these flies, and often in a favorable location hundreds may be caught in a few hours; but the most satisfactory manner of catching is by means of a cyanide traplantern, such as is described by Professor Needham (1901, p.398). By means of it several thousand specimens may be taken in a single night. The most favorable time for setting the lantern is a sultry, cloudy night, during the summer or spring; and the most favorable location is near the bank of a pond or creek.

The larvae and pupae and sometimes the eggs also may be scooped from the bottom of the pond by means of a small coffee-strainer net; or swept by means of a brush into a cloth sagnet from the surface of the rocks at the bottom of the shallow creek as described by Professor Needham (1899, p.5). From thence they are transferred to jelly tumblers, or for those forms which require rapidly flowing water to a jar from which the water is drawn as rapidly as it enters by means of a continuous siphon as described by Professor Comstock in "Insect Life," p.330. If the larva is nearly full fed, but a short time will be required for it to transform. If the specimens are still quite small, some

dead leaves and rubbish may be put in the glass for them to feed upon. The larvae of Chironomus usually hide themselves from view, and in the mud and debris form tubes which open at the surface. When placed in a jar their chief anxiety is to bury themselves in the mud, and very soon they will gather bits of dead leaves and particles of sand about them, binding them together with viscid threads passed out of the mouth, and in a short time will be completely concealed in a rough tube. These tubes are frequently seen upon the surface of dead leaves, on stones, sticks, etc. One species is known to be a leaf miner (Pettit, 1900). The larvae of species belonging to the groups Ceratopogon and Tanypus usually do not form tubes, but remain free. Specimens captured in the fall may live all winter and not transform until spring. Some specimens of Ceratopogon taken by the writer in September lived until the following May in the larval stage, and it is probable that they live thus nearly a year. The larvae may be found all the year around, while the adults are common excepting in the dead of winter, and a few specimens may be found even at that season.

The larvae are best preserved in alcohol, either first killing them in hot water, or placing directly in the alcohol. If any peculiarity of color marking is observed it should first be noted, as the spirits soon remove much of the pigment. The adult should be mounted with great care, either upon an elbow pin (MacGillivray, 1903b), or upon a minutien nadel, a short and very slender headless pin, thrust through a small piece of cork or pith and then into the under side of the thorax of the fly. Through the other end of the cork an ordinary insect pin is placed, and the specimen is then ready for the cabinet. It is also very desirable to preserve some specimens of each species in alcohol, or better still, in a mixture of formaldehyde and glycerine. The latter preserves the original colors quite well, especially if kept in the dark. These specimens should be put in very small vials and should, of course, bear the same number label as the pinned specimen. The fore tarsi of the genus Chironomus are very easily broken off, and therefore it is quite necessary that great care should be observed in preserving them since their presence is necessary in the determination of

some of the species. It is the practice of the writer to remove one wing and all the legs from one side of at least one specimen of each species and to mount them (preferably dry) upon a slide; this method allows of ready measurement and comparison.

Characteristics of egg, larva, pupa, and adult

The adults may be characterized as follows: More or less mosquito like in form, seldom reaching ten millimeters in length. The head is small, somewhat compressed, palpi usually four-jointed; proboscis short; antennae of variable length, from six to fifteen jointed; the first joint disk-like, the last one elongated, the male antennae usually plumose. Eyes reniform or oval; ocelli rudimentary or wanting. Thorax highly arched, frequently projecting over the head, without transverse suture; scutellum small and hemispherical; metathorax well-developed. Abdomen long and slender, eight-jointed, the hypopygium projecting forceps-like; ovipositor but little developed. Legs usually long and slender; coxae moderately long; tarsi frequently very long. Wings either bare or hairy; the veins of the costal margin being stout and in marked contrast with those in the other part of the wing, which appear to be fading out. Venation variable. The larvae usually have blood or tracheal gills, and are soft-skinned and worm-like. The pupae are free, some are active and resemble Culex, others float upon the surface of the water and still others remain at the bottom of the pond until ready to emerge.

The flies with which they might be confused are the crane flies and the mosquitoes. The former (Tipulids) are usually larger, have proportionately longer legs, have more numerous and more distinct wing-veins, and have a V-shaped suture upon the dorsum of the thorax. The latter (Culicids) have scales upon the wing, and all, excepting the subfamily Corethrinae, have an elongate biting proboscis. The adults of the genus Chironomus have a peculiar habit of holding their fore legs high above the surface upon which they stand, while the mosquitoes usually hold up their hind legs.

There is one other family of flies, the Stenoxenidae, which must be distinguished from the Chironomidae. This

peculiar family has but a single genus, a single species, and is represented by but a single specimen, which is now in the United States National Museum. This family will fall in the couplet with the Chironomidae in the key given by Comstock (1895), and by Williston (1896), but differs from all the members of this family by its peculiar wing venation (pl.35, fig.29). The description of the family was first given by Mr. Coquillett (1899a).

The eggs

The eggs of most of the Chironomidae are deposited in water; some species in swift flowing water, others in sea or lake water, while most of them lay them in stagnant pools or ponds, or in slow flowing streams. The eggs of a few species are deposited in bark, in manure, and in debris. Some species lay them in strings resembling somewhat a minature string of toad's eggs; while others lay them in clumps. The eggs themselves are elongate, cigar-shaped, usually pointed at each end. They hatch in a few days.

The larvae

The larvae are worm-like, but vary somewhat in form with the different genera. Most of them are aquatic, while a few live in the earth, in manure, or under bark (pl.16, fig.4; pl.17, figs.1 and 4; pl.19, fig.9).

Excepting some of the Ceratopogon they are provided with both thoracic and anal prolegs, and move by creeping in a manner somewhat like a geometer larva, without, however, such regularity, nor does the middle section hump up, but loops irregularly to one side or the other. Many species are blood-red in color, and hence are frequently known as blood-worms. They have a distinct head with well-formed labrum, labium, epipharynx, hypopharynx, mandibles and maxillae, the mandibles moving in oblique planes. The body is distinctly segmented, usually with twelve joints besides the head, the three thoracic segments being but little thicker than those of the abdomen. The twelfth segment is provided with a pair of prolegs, some caudal setae and blood gills: sometimes there are two pairs of conspicuous blood gills upon the ventral surface of the eleventh segment also. The

terrestrial larvae of Ceratopogon have prominent spines and setae upon the body, while the aquatic forms are nearly devoid of them (pl. 17, figs. 1 and 4). The aquatic larvae of Ceratopogon have no prolegs and the body is very slender and snake-like. The larvae can exist at great depths, and have been fished up from the bottom of deep lakes. They have been found in salt water (Packard, '70a).

The pupae

The pupae of Chironomus are frequently found in the old larval cases; others swim very freely near or at the surface after the fashion of a pollywog. The pupa of Tanypus is active and resembles that of Culex in form and habit. The pupa of the aquatic Ceratopogon is more elongate than Tanypus, is not active, and floats, nearly motionless, in a vertical position. All of the pupae have an enlarged thorax and usually a pair of respiratory tubes or filaments, while the caudal end is somewhat broadened and paddle-like or prolonged into two-pointed lobes, with ciliate margin.

The imagines

To the imaginal characters of the family already given the following may be appended:

The head is small, spheroidal, flattened where it joins the thorax, in some genera somewhat hollowed out between the eyes. The compound eyes are large, with conspicuous facets and distinctly separated from each other. They are kidney-shaped (reniform); that is, hollowed out around the base of the antennae. The ocelli are wanting. The front, the space between the eyes, is limited by the upper margin of the head and a line drawn through the root of the antennae. The vertex is the uppermost part of the front, near the margin of the occiput.

The face is the portion below the antennae, which is prolonged more or less downward to form the proboscis. The oral margin and an indefinite space immediately contiguous to it is called the epistoma or peristoma. The epistoma is usually convex, provided with setae or sensory hairs. The maxillary palpi are the slender, usually four-jointed appendages, the most conspicuous of the mouth parts. The labrum, hypopharynx and labium differ with

the different genera. In Chironomus and allied genera there is no trace of mandibles. In Ceratopogon the mouth parts are fitted for piercing. For homologies of the mouth parts, see Kellogg's papers in Psyche, 1899. The antennae or feelers are variable in form and number of joints; the first visible joint (called 2d joint by Miall and Hammond 1900) is usually enlarged, followed by a second which is sometimes also somewhat enlarged, these two being called the scape. These are always more or less differentiated from the remainder, which constitute the flagellum. In the male the joints of the flagellum are usually provided with long hairs. The first joint of Miall and Hammond (1900) is the extremely short hidden one, which is sunk in the head, and almost entirely occupied by the muscles which move the antennae to and fro. The next joint, the large one, exhibits a peculiar structure, which is believed to serve for the perception of sound. (M. and H. 1900, and Mayer 1874.) The head is connected with the thorax by a neck, whose cuticle is membranous.

The thorax is composed of three parts, the prothorax, the mesothorax and metathorax. The prothorax is quite narrow, forming a rounded collar back of the neck, within which are the muscles of the foreleg. On the dorsal surface it appears as a narrow band with a median incisure and suture. The humerus or humeral callus belongs also to the prothorax according to Miall and Hammond (1900). It is called the paratreme by Lowne. The mesothorax is very large; it is highly arched, and in some it projects somewhat over the head. On its fore edge is the anterior thoracic spiracle. The upper or dorsal surface of the mesothorax is often called the mesonotum, and it has attached to it at its posterior margin, and cut off from it by an impressed line, the scutellum, a small, semioval body, which really belongs to the mesothorax (see pl.31, fig.16, Chasmatonotus). The wings are attached to each side of and just below the scutellum. Behind and beneath the scutellum is a smooth and rather prominent oval-arched portion, the metanotum or upper portion of the metathorax (or post scutellum of Miall and Hammond 1900). Below and between the fore and middle legs is a very prominent hemispherical part (especially in Chironomus), the mesosternum. The sides of the body in front of the wings are called the pleura, and the under surface of

the thorax as a whole is called the sternum or pectus. The intermediate legs are attached to the hind part of the mesosternum by oval sockets. The metathorax is much smaller than the mesothorax. Its dorsal surface, called the metanotum, has already been mentioned. On the side is the posterior thoracic spiracle, and above it is the haltere (balancer or poiser) the rudimentary hind wing, a slender organ with a dilated head. The ventral surface of the metathorax is short and narrow and is largely occupied by the insertion of the hind legs.

The abdomen is composed of nine segments more or less closely fused together. In the male especially it is long and slender and terminates with the genitalia. The genitalia varies greatly with the different genera (pls. 32, 33). The anus opens on the dorsal surface of the ninth segment. The under surface of abdomen is sometimes called the venter.

The three pairs of legs are long and slender, especially so in Chironomus, are attached to the prothorax, mesothorax and metathorax, and are called respectively the front, middle and hind pairs. The older writers who used the Latin terminology spoke of the forelegs as pedes antici, the middle legs as pedes medii, and the hind legs, pedes postici. When they spoke of the fore and middle legs together they called them pedes anteriores. Some writers still use the term anterior legs for fore and middle pairs, and posterior legs for the middle and hind pairs. The coxa is the part attaching the leg proper to the thorax; while the trochanter is the short, small, ring-like portion between the femur and coxa. The femur or thigh is the stoutest portion of the leg; the tibia is the next part succeeding the femur. The tarsus is the distal division of the leg and is composed of five joints, of which the first, that next the tibia, is called the metatarsus. The ungues or claws are two hooklets on the underside of the last tarsal joint. In most genera these are simple, but a few have uniserrate or bifid claws. The pulvilli, two pad-like fleshy cushions attached to the last joint of the tarsus below the claws, are often present. The empodium is a median appendage between the claws, and is usually present also. The usual shape in this family is that of a sickle-shaped process, pectinate on the convex side.

The wings are usually rather slender and delicate, with the anterior veins (those nearest the costal border) rather stout, while the posterior veins are usually very delicate and indistinct. The surface of the wing is delicately hairy in a number of species, though the majority have bare wings.

Below is given the Comstock-Needham terminology of wing venation as used in this paper, together with the equivalent terms of the Schinerian system as applied with but slight modifications to the Nematocera generally:

Comstock—Needham		Schinerian
Costa (C)	=	Costa
Subcosta (Sc)	=	Auxiliary
Radius (R_1)	=	First longitudinal
R_{2+3}	=	Second "
R_{4+5}	=	Third "
Media (M)	=	Fourth "
Cubitus (Cu)	=	Fifth "
Anal (A)	=	Sixth "

The costa ends at or before the tip of the wing in all the genera; the subcosta, though sometimes rather indistinct, is usually present; the radius is stout and well developed, and usually with two or three branches, R_2 in some genera appearing like a crossvein; the media usually present and always simple; the cubitus is nearly always two-branched; anal vein usually present though delicate. Compare pl.17, figs.13-16, pls.27 to 31. The halteres, the slender organs with knobbed ends which are supposed to be the rudimentary second pair of wings, are rarely wanting.

For a description of the internal anatomy of both larva and imago the reader is referred to Miall and Hammond's work on the harlequin fly (1900).

A large number of genera have been erected to contain the species of the world. Of these some may be placed as the synonyms of others, leaving still over 40 valid genera. In order to facilitate identification a key to the North American genera is offered besides the more general one for the genera of the world.

KEYS TO GENERA OF THE CHIRONOMIDAE

Larvae

a Abdomen with prominent rounded elevations or cushions, with rows of teeth on the inferior (anterior) angles of the segments
13. Psamathiomyia

aa Abdominal segments without these cushions

b Aquatic footless snake-like larva, or terrestrial larva with thoracic and anal feet, and many setae and bristles on body segments, pl.17, figs. 1 and 4.....(*Group Ceratopogon*)

bb Not as above

c With retractile antennae, the latter often quite long, long stilt-like legs, the caudal tufts of hair mounted on cylindrical processes, pl.19, fig.9.....(*Group Tanypus*)

cc Not with all the above characters

d With the two caudal hair tufts mounted on cylindrical projections

e With six seta-like processes on each of the caudal projections, three long and three short. Eyes prominent, round, on anterior angles of the head, pl.34, figs. 21, 22, 23 (European)
26. Wulpiella

ee Eyes not on anterior angles of head

f With blood gills on venter of eleventh segment
31. Hydrobaenus

ff With blood gills only at end of twelfth segment
44. Metriocnemus

dd Caudal tufts on small rounded papillae

e Antennae elongate, at least one half and often as long or longer than the head; compare also pl.20, fig.10

f With two anal blood gills, pl.36, figs. 1, 2, 3
25. Corynoneura (lemna)

ff With four anal blood gills; antennae mounted on basal prominence, pl.26, figs. 5, 8.....42. Tanytarsus

ee Antennae short

f Larvae usually blood red; eleventh body segment with two pairs of blood gills, pl.15, fig.4..38. Chironomus (pt.)

ff Larvae greenish, yellowish, or whitish

g The maxiliary palpus usually noticeably longer than broad. Larva in pools, pond water, or slow streams, pl.23, figs. 3 and 16.....38. Chironomus (pt.)

gg Palpus about as long as broad. pl.24, figs. 5, 12, 20

h Full-grown larva not over 6 mm. long, green or bluish-green in color. Anterior abdominal segments of greater diameter than the posterior ones. Mandibles often transversely wrinkled; the anterior prolegs usually with pectinate setae { 39. Cricotopus / 41. Orthocladius

hh Full-grown larva over 6 mm. in length; mandible not transversely wrinkled

i Labium with its teeth rounded, pl.20, fig.9

35. Diamesa waltlii.[1]

ii Labium with its middle tooth broadly truncate

37. Thalassomyia fusca

NOTE.—See addenda for several anomalous species.

Pupae

a Pupa floats nearly motionless in a vertical position at the surface of the water, pl.17, fig.11 ..... (*Group Ceratopogon*)

aa Pupa not as above

b Active pupa swimming with a jerking motion in the water like a culex pupa, pl.19, fig.8 ..... (*Group Tanypus*)

bb Not culexlike

c With long setae or filaments at caudal end

d Caudal filaments very numerous and forming a caudal paddle, pl.22, fig.14, and pl.26, fig.15

e Thoracic respiratory organs a tuft of filaments, pl.16, fig.2

38. Chironomus

ee Respiratory organs consisting of a main shaft with lateral hairs or setae. Abdomen with setae and bristles.

42. Tanytarsus

dd Caudal appendage with long setae

e With eight long setae on each side of caudal appendage, pl.36, figs. 4 and 5 ..... 25. Corynoneura lemnae

ee With a tuft of long setae on each side; thoracic respiratory organ a simple finger-like process, pl.34, figs. 5 and 8

31. Hydrobaenus

cc With three or four pairs of short setae, a plate-like sucker or with a paddle

d Plate-like sucker at caudal end, pl.34, figs. 14 and 15

29. Telmatogeton (St Paulii)

dd With two or three pairs of short setae or with paddle

e Without thoracic respiratory tubes. Abdominal segments with a fringe of conspicuous spines or setae or projections, pl.48, fig.13, and pl.50, fig.10 in Bul. 68 N. Y. State Museum, 1903

35. Diamesa
37. Thalassomyia
44. Metriocnemus

ee With respiratory tubes. Abdominal segments usually without a fringe of prominent setae, pl.24, fig.24, also pl.24, figs. 13, 14, 15

39. Cricotopus
41. Orthocladius

[1]The larva of Thalassomyia congregata (an European species) has a labium like Diamesa waltlii.

Imagines

NOTE.—In counting the antennal joints the large basal joint is included, but not the hidden first joint.

a Wings absent or rudimentary
b Wings reduced to mere vestiges, legs short and not slender, antenna with seven joints, mouth parts rudimentary, pl.36, fig.13, female
14. Clunio
bb Rudimentary wings reaching at least to the end of the first abdominal segment
c Halteres wanting, wings in the form of a flattened racket, tarsal claws with a little subapical tooth. Palpi four-jointed; antenna five (?) jointed.....10. Belgica
cc Halteres distinct
d Palpi four-jointed; antenna of the female four-jointed, of the male six-jointed, pl.35, figs. 16, 21, 22.....11. Eretmoptera
dd Palpi two-jointed; antenna of the female six-jointed
e Second joint of antenna like those following, monilliform, pl.37, figs. 5, 6, 7.....12. Halirytus
ee Second joint longer than those following; male antenna also with six joints, pl.35, figs. 4 to 9...13. Psamathiomyia
aa Wings present
b The M-Cu crossvein present (i. e., cell M closed by a vein), pl.37, fig.24
c Antenna with twelve or more joints
d Antenna with fourteen joints usually plumose; fourth tarsal joint usually shorter than the fifth; wing bare, pl.30, fig.13, male
35. Diamesa
dd Not as above
e Antennae with fifteen joints both in male and female; plumose in the former; the vein M simple, pl.27, figs. 1 to 15
(*Group Tanypus*)
f Wing bare
g Fork of the cubitus petiolate.....15. Procladius
gg Fork of cubitus proximad of crossvein
16. Anatopynia n. gen.
ff Wing pubescent
g Fork of cubitus proximad of crossvein
h Antennae of male and female each with fifteen joints, R_2 and R_3 distinct.....17. Ablabesmyia n. gen.
hh Antennae of female with twelve joints, the male with fifteen joints, R_3 indistinct (Australian genus)
18. Isoplastus
gg Fork of cubitus petiolate.....19. Tanypus
ee Antennae with twelve or fourteen joints; wings hairy; cubitus not forked; anterior crossvein long and very oblique, pl.37, fig.16 .....20. Pentaneura
cc Antennae with less than ten joints
d Crossvein near basal third of wing, pl.37, fig.11. Antennae about eight-jointed (Chile).....21. Podonomus

dd Crossveins near middle of wing

e Palpi six-jointed; antennae seven-jointed; wing venation as shown on pl.37, fig.21 (Chile).....22. Heptagyia

ee Palpi four-jointed

f Antennae of female seven or eight jointed: male antennae fourteen-jointed; wing bare.....35. Diamesa

ff Antennae of female with eight joints, the male with nine, short-haired .....36. Eutanypus

According to the description the female of Eutanypus does not seem to differ from the female of Diamesa.

bb The M-Cu crossvein absent

c Wing with four or five very indistinct longitudinal veins; wing club-shaped, the anterior margin with a long curved seta, the antenna with about twelve joints.....23. Corynocera

cc Wing margin without a long curved seta

d Proboscis and palpi rudimentary; abdomen shorter than the thorax (female apterous).....14. Clunio

dd Palpi not rudimentary

e Antennae with not more than ten joints

f Antennae six-jointed

g The R–M crossvein, if present, at the basal quarter of the wing

h The R–M crossvein near basal quarter of the wing, pl.37, fig.13 (Chile).....24. Spaniotoma

hh The R–M crossvein coalescent with the longitudinal veins; wing club-shaped; the anterior cells thickened, pl.36, fig.7.....25. Corynoneura

gg The R–M crossvein near the middle of the wing

h Wings hairy; antennae with the four intermediate joints verticillate with very long hairs; male unknown (Europe), pl.34, fig.20.....26. Wulpiella

hh Wings with margin ciliated; antennae with sparse verticils of spreading hairs (Kerguelen Island), pl.37, fig.1 .....27. Limnophyes

ff Antennae with seven to ten joints

g Antennae with ten joints, not plumose; costal cell thickened, pl.36, fig.7.....25. Corynoneura (male)

gg Antennae with seven or eight joints

h Thorax with a longitudinal fissure; wings black with white markings, pl.31, fig.16, and pl.27, fig.16

28. Chasmatonotus

hh Thorax without this fissure

i Claws cleft, venation as figured; antennae seven-jointed in male and female, pl.34, fig.16

29. Telmatogeton

ii Claws simple

j Very small species; black, including its legs, wings and halteres; male with fourteen nearly bare joints, female with seven joints; legs with woolly hairs; metatarsi somewhat elongated; claws distinct, pl.34, figs. 6–11.....31. Hydrobaenus

jj Not such flies

k Antenna of male with eight joints; female like Orthocladius, (Australia), pl.36, fig.26 32. Doloplastus

kk Antenna of male not eight jointed; the female with seven joints

l Wings very short, in the female scarcely reaching the middle of the abdomen; the abdomen with a seta-like tubercle near the tip on each side; fore tibia longer than the metatarsus (Spitzbergen) .....33. Smittia

ll Wings of moderate length

m Thorax prolonged and bent downward; halteres hammer-like, pl.35, figs. 26, 27, 28 (Argentina). Synonym of Chironomus? 34. Burmeisteria

mm Thorax highly arched; halteres with knob (*Group Chironomus*)

n The fourth tarsal joint obcordate, shorter than the fifth. {37. Thalassomyia / 45. Scopelodromus}

nn Tarsal joint linear

o Wings bare

p Front metatarsi as long or longer than the tibiae.....38. Chironomus

pp Front metatarsi distinctly shorter than their tibiae

q Legs black and white annulate, at least the fore pair...39. Cricotopus

qq Legs not so banded

r Posterior branch of cubitus sinuous, pl.30, figs. 1 to 4 40. Camptocladius

rr This branch straight, gently arched, pl.30, figs. 5 to 10 41. Orthocladius

oo Wings hairy

p Front metatarsi longer than their tibiae 42. Tanytarsus

pp Front metatarsi shorter than their tibiae
q Thorax produced conically in front over the head; hind tibiae dilated and hairy, pl.34, fig.24
43. Eurycnemus
qq Thorax moderately produced; hind tibiae not dilated
44. Metriocnemus
cc Antennae with thirteen to fifteen joints
f Antennae fifteen-jointed; European and tropic genera
g Wing hyaline; legs very long; antennal joints of varying lengths, pl.35, figs. 1, 2, 3.....30. Macropeza
gg Wings spotted (West Indies and Mexico)....5. Oecacta
ff Antennae with fourteen or fewer joints
g Thorax rounded and not produced over the head; antennae with thirteen or fourteen joints; legs of moderate length
h Antennae with thirteen joints; wing venation as shown on pl.35, figs. 10 and 14
i Palpi with three joints. (This is probably a synonym of the next).....2. Tersesthes
ii Palpi with four joints.....1. Leptoconops
hh Antennae with fourteen joints, plumose in the male, sparsely haired in the female; wing venation as on pl.17, figs. 13 to 16.....(*Group Ceratopogon*)
i Wings hairy; last joint of tarsus with an empodium
j Empodium well developed; almost as long as the claws, these without setae, pl.18, fig.7
3. Ceratopogon
k Hind metatarsi shorter than the second tarsal joint, or both of equal length
(Sub. gen. Forcipomyia)[1]
kk Hind metatarsus longer than the second joint
(Sub. gen. Ceratopogon)
jj Empodium not so distinct, less than half as long as the claws; these furnished with setae on the under side, pl.18, fig.8.....4. Culicoides
ii Wings bare; pulvilli and empodium wanting
j Wing with R_1 distinctly separated from R_{2+3} and not connected with it by the crossvein-like R_2, pl.17, fig.15.....6. Bezzia
jj Wing with R_2 present; cells sometimes indistinct, pl.17, figs. 13, 14, 16
k Media wanting, pl.17, fig.13
7. Brachypogon

[1]According to Kieffer (1902) this subgenus can not stand, because in some species one sex would be classed here and the other sex with the next subgenus.

kk Media present.....(*Xylocrypta*[1])
l Femora unarmed.....8. Ceratolophus
ll Some of all the femora spinose beneath
9. Palpomyia
m Neither fore nor hind femora thickened[2]
n Having hairy soles (plantae)
1. Subgenus Alasion
nn Having spinose soles (plantae), pl.17, fig.16
2. Subgenus Sphaeromyas
mm Either fore or hind femora thickened
n Hind femora thickened, spinose beneath
3. Subgenus Serromyia
nn Fore femora thickened, pl.37, fig.9
4. Subgenus Heteromyia
gg Thorax produced over the head; legs usually quite long; antenna of the male usually with fourteen joints; that of the female with seven joints. (Go back to *ii* following *i*, 29 Telmatogeton, page 90, and read through to *qq*, Metriocnemus)

KEY TO GENERA OF THE NORTH AMERICAN CHIRONOMIDAE

a Wings rudimentary (Pacific coast), pl.35, figs. 15 to 24
11. Eretmoptera
aa Wings present
b The M–Cu crossvein present, pl.37, fig.24
c Antennae with fifteen joints; both in the male and the female the apical joint oval, pl.27. (Go back to the Group Tanypus, *f*, p. 89, of the preceding key.)
cc Antennae with fourteen or fewer joints, when the apical joint is oval then antenna with fewer than ten joints
d Antenna of the male with fourteen joints, the apical joint very long and cylindrical; antenna of the female with seven or eight joints; fourth tarsal joint obcordate; wings bare, pl.30, fig.13
35. Diamesa
dd Antenna of male with nine joints, short haired; antenna of female with eight joints. The female does not appear to differ from Diamesa .....36. Eutanypus
bb The M–Cu crossvein absent
c Wing club-shaped, the costal cell thickened, pl.36, fig.7; antenna of male with ten, the female with six joints..25. Corynoneura
cc Not as above
d Thorax with a longitudinal fissure; wings black with white markings; antennae seven-jointed in male and female, pl.27, fig.16, and pl.31, fig.16.....28. Chasmatonotus

[1]This division is called Genus Palpomyia by Kieffer (1902).
[2]This division is called Subgenus Palpomyia by Kieffer.

dd Thorax without a longitudinal fissure
e Claws cleft; antennae seven-jointed in male and female; halteres long (Alaska and Oregon).....29. Telmatogeton
ee Claws not cleft
f Antennae with thirteen to fifteen joints
g Antennae with fifteen joints; wings spotted (West Indies and Mexico).....5. Oecacta
gg Antennae with fourteen or fewer joints
h Thorax rounded, not produced over the head; antennae with thirteen or fourteen joints; legs of moderate length
i Antennae with thirteen joints; wing as figured, pl.35, fig.10. Palpi with three joints. (=Leptoconops Skuse?).....2. Tersesthes
ii Antennae with fourteen joints; wing venation as figured, pl.17, figs. 13 to 16. (Go back to the Group *Ceratopogon hh* on p.92 of the previous key.)
ff & hh Thorax produced over the head, legs usually long; antennae of male with the fourteenth joint long, slender, and plumose (female with seven joints). (Go back to group *Chironomus mm*, p.91 of previous key.)

The subdivision of the Group Ceratopogon into smaller genera and subgenera as given in the first key is adapted from one given by the Abbe J. J. Kieffer (1902), with some slight modifications. The three South American genera Psychophaena, Tetraphora, and Didymorphleps, have been omitted from the key. They are probably synonymous with previously described genera, though from the brief descriptions it is impossible to say. They all belong to the Group Ceratopogon, and their descriptions are all reproduced upon a subsequent page.

Genus 1. Leptoconops Skuse

Proc. Linn. Soc. N. S. W. 288. 1889. (Pl.35, fig.14)

Antennae in female 2+11 jointed; first joint of scapus large, disciform; second smaller, globose; flagellar joints globose, gradually diminishing in size, more ovate towards apex, terminal joint elongate-ovate. Proboscis prominent. Palpi four-jointed; first and second joints small, third greatly incrassated, about three times the length of the first or second; fourth not as long as last, slender cylindrical; wings naked. All longitudinal veins taking their origin at the base of the wing. Venation as figured. Australian species.

Genus 2. Tersesthes Townsend

Psyche. 1893. 370. (Pl.35, figs. 10, 12, 13)

Antennae 13-jointed, set in large, circular excavations in the middle of the head; first joint largest, round; second more elongate, smaller, but larger than the following joints; last joint elongate conical; intermediate ten joints equal, submoniliform, with hairs somewhat shorter than width of joints. Palpi three-jointed, longer than proboscis, first joint shortest, second joint swollen, third narrow with a terminal whorl of hairs; proboscis consisting of a lower lip (labium), with the lancets free but usually more or less approximated to its anterior aspect, both of equal length, extending straight downward, about as long as the head; lancets serrate on the outer edge at tip. No ocelli. Eyes reniform, rather deeply excavated on the inside margin, dichoptic, front averaging one third the width of the head. Thorax moderately stout, but not humped, a little wider than the head, longer than wide, without transverse suture, scutellum prominent. Abdomen seven-jointed, somewhat elongate, not wider than the thorax, first three segments subequal, fourth smaller, three terminal segments narrowed, ovipositor exserted, consisting of two clavate pieces joined laterally on the basal half, and terminally divergent. Wings moderately broad, not elongate; hind margin with a delicate fringe of hairs, the surface sparsely clothed with very short, microscopic hairs (revealed only with a high objective); six longitudinal veins, first and second approximated, strongest, ending at about one third the length of the wing; third gently curved distally and ending near the wing apex; fourth apparently forked, fifth distinctly forked, sixth becoming obsolete before fork of the fifth; an apparent rudiment of a seventh vein; no crossveins, except one at extreme base of wing, which connects the first and sixth veins, marginal vein not extending beyond the tip of the wing. Legs slender, not dilated, coxae not elongate; hind tibiae spurred, middle and even front tibiae with microscopic spurs; metatarsi elongate, second joint of hind tarsi also elongate, of middle tarsi somewhat elongate, of front tarsi scarcely so, penultimate tarsal joint of all the feet shortened, the last and ante-penultimate joints about equal; no pulvilli.

Professor Mik in the Wiener Ent. Zeitung, 1894, p.164, says: ".....Dieses Geader lässt sich ohne Mühe auf jenes der Gattung Corynoneura Winnertz ..... zurückführen (Vergl. V. d. Wulp Dipt.—Neederl. 1877. Pl.VIII. fig.6), ohne dass ich hiermit etwa den Bestand der Gattung Tersesthes anzweifeln möchte ....." Upon comparison of this description with that of Leptoconops Skuse, and of pl.35, fig.10, with fig.14, it will be seen that these genera are certainly very closely related if not identical. The only marked difference is that Leptoconops has two small basal palpal joints while Tersesthes is said to have but one (i. e. Leptoconops has four-jointed and Tersesthes three-jointed palpi). Only one species.

Tersesthes torrens Townsend

1893. Tersesthes Town. Psyche. 371

Female. General color blackish; eyes dark brown; antennal excavations cinnamon color, nearly three times the diameter of first antennal joint; front, face and lancets shining black, the front with four blackish hairs on vertical margin arising from four papillae; antennae black, clothed with whitish pubescence; palpi blackish, labium brownish with some whitish pubescence terminally; occipital orbits with a few black hairs. Thorax and scutellum deep shining black, smooth, glabrous, except that the thorax has some scattered black hairs anteriorly. Abdomen soft opaque brown, varying to light brown, in some of the specimens flavous or rufous at base; balsam mounts showing two oval black spots (bodies?) at base of fifth segment; ovipositor brownish. Legs blackish, tarsi brownish, tibiae slightly so. Wings grayish hyaline, with hardly a smoky flavous tinge, the delicate fringe of hind margin somewhat longest on anal angle where it terminates abruptly; veins pale, except first and second longitudinal veins, which are brown and end in a brown stigma on costal margin (the first vein becomes obsolete just before reaching stigma); halteres brownish, knobs whitish.

Length of body (inc. ovipositor), one and three-fifths millimeters (empty) to two and one-fifth millimeters (abdomen distended with blood); of wing one and one-fifth millimeters. Fresh and alcoholic specimens are slightly longer. Described from both dried and alcoholic specimens and balsam mounts. Six specimens collected June 21, on Continental divide, Socorro county N. Mex., 7000 ft.

GROUP CERATOPOGON Meigen
Illiger's Mag. 11:261. 1803

This group may primarily be divided into two series; those species having hairy wings belonging to one and those with bare wings to the other. The larvae of the former group usually live under bark, while those of the latter are aquatic. The larvae of the first group may be characterized as follows: The head is short, the antennae minute, the mouth parts are small, and the mandibles apparently move in a more or less vertical plane. The mandibles in some species have several apical teeth (pl.17, fig.6). The body consists of 12 well-marked segments of which the first three, usually a little larger than the following, belong to the thorax. The head, thorax, and abdomen are provided with various spines, setae, and tubercles, differing with the species. On the ventral surface of the first thoracic segment is the anterior proleg, a short, more or less cylindrical process, divided into two branches, at the tip of each of which is a crown of a few claws (pl.17, fig.7). The last abdominal segment has a pair of prolegs, each with a few bilobed claws (pl.17, fig.8). Blood gills appear to be present and consist of delicate white filaments. The pupae of the members of this group remain partly sticking in the larval skin, the thorax and the first three or four abdominal segments projecting out (pl.17, fig.9). The thorax is large, prominent, the respiratory trumpets (fig.9, *t*) when present are small and inconspicuous; the abdominal segments variously armed with spines and setae.

The eggs and the method of egg laying of several members of the second group will subsequently be described. The larvae of the second (aquatic) group swim well with a writhing snake-like motion. They are usually whitish in color, slender, 12-jointed (not counting the head), the thoracic segments shortest; the middle abdominal segments of the greatest diameter, and the last segments usually longest (pl.17, fig.1). The head is very small, somewhat elongate, oval, with a pair of eyes, each eye consisting of one or two pigment spots. There are usually a few setae upon the head. The antennae (pl.18, figs.1a and 3a) are very small and inconspicuous, and in all species which I have seen, two-jointed. Of the mouth parts the

mandibles are the most conspicuous, slender at the tip and simple, but enlarged basally (pl.18, fig.4). The labrum is rounded and provided with one or two pairs of papillae, which may be larger than the antennae and of similar construction (pl.18, fig.1b). The maxillae (fig.2*mx*) are fleshy, lobed, and each provided with a large two-jointed palpus (p). The labium is quite small and inconspicuous, and differs from the corresponding part in Chironomus in having a soft and rounded edge, but upon its inner surface forming the floor of the mouth cavity it is heavily chitinized and formed into one or more cephalad projecting teeth (pl.18, fig.2*l*). The thorax and abdomen are wholly without prolegs; usually with but few or no setae excepting at the caudal end where there are about eight long setae and a few short ones. Projecting from the rectum, when not retracted, may be seen the delicate white blood gills.

The pupa is brownish, somewhat tapering, with an ovate thorax. It floats nearly motionless at the surface of the water, or is attached to plants a little above the surface but still within the water film. The respiratory trumpets are slender, and more or less cylindrical with the aperture slightly enlarged (pl.18, figs.9 and 10*t*). The abdominal segments are provided with spines, setae and tubercles. The anal fin ends in two pointed lobes (pl.18, fig.11). Professor Mik, on page 183 in Vol. 7 of the Wiener Ent. Zeit., described a species of Ceratopogon with hairy wings, but having a footless larva. This form occupies a place between the above two groups; and its habitat, the very moist or wet, ulcerous parts of the stems of Aesculus hippocastanum, also suggests an intermediate form. This species differs from all known members of both groups in possessing instead of either setae or prolegs a retractile disk, on the periphery of which are arranged five pairs of curved spines. It agrees with the second group in having no prolegs, and with the first in having a mandible with a three-toothed margin.

The pupa has cylindrical, elongate respiratory trumpets; the abdomen is provided with spiny tubercles, and the caudal end has a crown of tubercles. The adult would be classified with Kieffer's genus Culicoides.

Another aberrant form, C. murinus Winn. is noted by G. Gercke on p.164, Wiener Ent. Zeit. Vol. 5. The larva was not observed, but the pupa, although of an aquatic form, gave rise to a hairy winged adult. The respiratory trumpets of this species are quite peculiar. They are elongate, cylindrical, and then suddenly contracted on the apical third. An Ithaca, N. Y., specimen, bred from the slender snake-like aquatic larva, also gave rise to a hairy winged adult. The larval skin was unfortunately lost. The pupa has a cylindrical breathing trumpet resembling the one described by Gercke.

The imago. The imagines of the group Ceratopogon are very small flies, commonly called "punkies," which differ from the other genera of this family in having more robust legs, in their wing venation, and in their not having the thorax projecting over the head. To this group belong the genera Ceratopogon sens. str., Culicoides, Bezzia, Brachypogon, Ceratolophus, Palpomyia (with its subgenera Alasion, Sphaeromias, Serromyia and Heteromyia), and probably Oecacta, Psychophaena, Tetraphora and Didymorphleps.

Head flattened in front; epistome slightly projecting; palpi four-jointed, the second joint longer or thicker than the others, the fourth almost as long as the second; proboscis somewhat projecting; formed for biting; antennae elongated, filiform, 14-jointed, the first joint annular, the following eight spherical or somewhat annular; in the male long plumose, in the female with few hairs, the last five joints in both sexes elongated, especially in the male, and furnished with short hairs; eyes reniform, the ocelli wanting. Dorsum of the thorax very convex, scutellum narrow, metanotum short. Abdomen eight-segmented, rather long, sometimes narrowed basally. Genitalia somewhat prominent. Legs moderately long and quite robust; especially the femora, which are often furnished with spines or setae; tibiae sometimes flattened; tarsi various, the claws with or without teeth or setae. Wings bare or hairy, folded over the back when at rest; the media simple, the cubitus always two-branched; wing venation of the types shown on plate 17, figs. 13 to 16; halteres distinct and uncovered.

Genus 3. Ceratopogon sens. str. (Kieffer)

Bul. Soc. Ent. Fr. 69. 1899. Ceratopogon Meigen pt. (1803).
(Pl.18, fig.7)

Wings long-haired, especially those of the female. Last joint of the tarsus with very apparent and hairy (not setose) empodium.

Other characters as in the group Ceratopogon. Type species C. bipunctatus Linn. There are numerous American species belonging to this genus.

Ceratopogon sp.

(Pl.17, figs. 4 to 8)

The larvae of this species were found under oak bark. They are five or six mm. long, bristly, cylindrical, tapering slightly from the thorax to the caudal end; color whitish. Head dark brown, eye spots and mouth parts blackish; each of the thoracic feet armed with a circlet of about eight simple, blackish claws (fig.7), anal feet each with nine or ten bilobed blackish claws (fig.8). The mandible is as shown in fig. 6. The chaetotaxy of the head and body is shown in figs. 4 and 5. Each segment of the abdomen has upon each side a long, honey yellow curved bristle with slightly enlarged end, two slightly curved black, barbellate bristles, two slightly curved long black setae, and upon the dorsum a pair of honey yellow spear-shaped setae. The thoracic segments are similarly armed, except that the first has two slender yellow setae instead of the spear-shaped pair.

The pupa is 2.5 to 3 mm. in length, yellowish, head darker (fig. 9). The thorax with a triangular shield-like dorsum, with a pair of yellow barbellate blunt filaments anteriorly, laterally and posteriorly; and a short pair in front of the reddish imaginal eyes. The respiratory trumpets (fig.9*t*) are small, rather inconspicuous, with the apical end enlarged. The mesothorax has two barbellate filaments; the first four abdominal segments each with eight yellow, pointed, delicately barbellate filaments and two shorter blunt ones. The remaining segments, which are concealed in the cast larval skin, are unarmed; the apical end is provided with a pair of slender, pointed lobes.

Only one specimen of the imago was reared and is not sufficiently well preserved to describe. For further descriptions of larvae and pupae of members of this genus the reader is referred to Mr W. H. Long's paper (1902).

Subgenus Forcipomyia Megerle in litt

Meigen Syst. Beschr. 1:59. 1818

Labidomyia Stephens Catl. Brit. Ins. 1829

The manuscript name Forcipomyia bipunctata Linn. was given to the species now known as trichopterus Meig., by Megerle and later Stephens grouped the species bipunctata, trichopterus, pictipennis Meig.,

nemorosus Meig., nemoralis Meig., and others under the name of Labidomyia without giving a description of the genus. The type species trichopterus has the characters of Ceratopogon sens. str., but has its metatarsus shorter, or no longer than the following joint, and the venation of the type shown on the pl.17, fig.14. The Abbe J. J. Kieffer, however, says this subgenus cannot stand because that in certain species the male would be classed as Forcipomyia and the female as Ceratopogon.

Genus 4. Culicoides Latreille

Gen. Ins. et Crust. 4:251. 1809. (Pl.18, fig.8)

Antennae filiform, 14-jointed, hairy; the second and the six following, cylindrical ovate; the four or five following these rather more elongate, subcylindrical, the last one largest, ovate cylindrical. The proboscis markedly longer than the head, conical. The wings deflected, the venation resembles that figured on pl. 17, fig. 14. The type is C. pulicaris L. (Ceratopogon punctata Meigen). Kieffer (1902) characterizes the genus as follows: The surface of the wing with long hairs, at least that of the female; the tarsi with minute pulvilli not half as long as the tarsal claws, the latter with long setae at the bases. A number of North American species belong to this genus.

Genus 5. Oecacta Poey

Memorias Hist. Nat. Cuba. 1:236. 1851

Judging from the description and figures given by Poey this genus is very closely related to either Ceratopogon or Culicoides. The only important distinction given in the description is the statement that there are fifteen antennal joints instead of fourteen. From the figure given it appears that the author had counted the basal articulation beneath the large basal joint as one, which would only make fourteen joints as reckoned for Ceratopogon. The wing venation, assuming Poey's drawing to be strictly correct, does not differ so markedly from a typical Ceratopogon as to exclude it from that genus. The venation resembles that shown on plate 17, figure 14, excepting that R_2 does not quite reach the margin, and R_2 seems to be wanting. R_1 terminates in the stigma. Since Professor Townsend (1897), who has seen this fly, did not question the validity of the

genus, I shall for the present regard it as distinct. The following is an abstract of Poey's description:

Antennal joints, fifteen; palpal joints, five; ocelli, tibial spurs, and pulvilli wanting; wings hairy; cells few in number; sexes similar. The antennae of the male appear to be a little more hairy than those of the female.

Oecacta furens Poey

Memorias, etc. 1:236. Tab. XXVII. 1851

Length 2 mm. from the head to the end of the wing; thorax bronze colored, spotted with fuscous; abdomen fuscous; legs whitish, the articulations and a ring upon each femur and tibia, fuscous; front and antennae rufous; wings whitish, spotted with fuscous; halteres yellow. The wings are broad, covered with minute scales and with a conspicuous fringe on the margin.

Townsend (1897) says: "Dry pinned specimens show the wings to be strongly iridescent in certain lights, the dark and white spots alike, as well as the veins and whole wing surface, especially noticeable being various rich shades of blue and violet. Poey remarks at some length on this peculiarity. When the wing is held up to the light and looked through the dark spots appear faint, excepting only the elongate rectangular black stigma; this can be seen with the naked eye."

Cuba (Poey); Mexico and Jamaica (Townsend).

Genus 6. Bezzia Kieffer

Bul. Soc. Ent. Fr. 69. 1899

Belongs to the group Ceratopogon. Wings bare, tarsi without empodium, radius 3-branched (i. e. without the cross-vein-like R_2). (Pl.17, fig.15). Type C. ornata Meigen. Several American species belong to this genus.

Bezzia setulosa Loew

1861 Ceratopogon Loew, Berl. Ent. Zeit. 312

(Pl.18, figs. 4, 5, 6, 9, 10, 11)

The larvae were found in the Renwick swamps, Ithaca, N. Y., July 10th. They are white without brown markings and about 7 mm. long. The head is brown, each eye consists of two nearly contiguous spots. On the dorsal surface of the head are several pair of small setae. The labrum is rounded, with two pairs of small apical papillae, one pair apparently jointed, and one or two

pairs with setae. Mandibles curved, slender at the apex, stout basally (fig.4). The hypopharynx lies rather far back from the mouth opening, about on a line with the eye spots. It is curved, like the jawbone of a mammal, the dorsal surface of the middle section being fringed. In fig. 5 this fringe is flattened down. The labium is rounded, and has a single cephalad projecting tooth on its inner surface. Upon the outer surface are two setae on each side (fig.6). The body is wholly devoid of setae excepting at the caudal end. At the caudal end there are eight long setae arranged in four groups of two each (pl.17, fig.3). Besides these there are four very small and delicate ones. The blood gills (retracted in most specimens) are white, short, slender, and lanceolate in outline.

The pupa is dark brown in color, with the abdomen slightly paler. Length 3.5 to 4 mm. The respiratory trumpet is slightly enlarged at the apical end (pl.18, fig.9), about five times as long as wide. Upon the dorsal surface is a group of about ten small setae. Upon the dorsal surface of the first abdominal segment there is a group of five or six very small setae on each side. The following segments, excepting the last two, have from 6 to 10 setae on the dorsal surface, arranged as shown in fig. 10. Upon the ventral surface each segment has from 8 to 10 very small setae, each placed on the apex of a prominent tubercle (fig.11). The anal fin consists of two pointed lobes with blackened tips.

To Loew's description of the imago (loc. cit.) may be added that the fore and middle tibiae sometimes have one or two stout black setae besides the fine hair-like setae; and in the female each claw has a very small tooth on the inner side. The male genitalia as shown on pl. 32, fig. 1.

Bezzia sp.

(Pl.17, figs. 10 to 12)

The larvae were taken from the stomach of a brook trout at Saranac Inn, N. Y. They do not appear to differ much from the larvae of B. s e t u l o s a, excepting that the labium possesses three teeth on the inner surface instead of one (fig.10). The pupa (fig.11) may possibly belong to this species, for it is the only species which was found in that vicinity at that time, but of it many specimens were found. The respiratory trumpet is as shown in fig. 12. Each abdominal segment has upon its ventral surface several elongate brown spots. The setae are short, and the basal tubercles smaller and fewer than in B. s e t u l o s a. The lobes of the anal fin are elongate and pointed (fig.11).

Adults bred from the pupae described above were preserved in alcohol, and hence the color characters are somewhat doubtful.

Female. Brownish, abdomen pale, legs brown and white, claws simple, no pulvilli nor empodium; fourth tarsal joint one-half as long as the fifth, posterior tarsi ciliate with hair-like setae, last joint with only a few hairs; wings bare, without the crossvein-like R_2; length 3.5 mm. Head and mouth parts brownish; antennae brown with white incisures; basal joint brown. Thorax brown (perhaps cinereous in dried specimens) with indications of dorsal stripes. Abdomen brown dorsally and white ventrally. Coxae brown, fore and middle legs white, with brown knees and articulations, hind legs brown, basal $\frac{2}{3}$ of the femora, basal $\frac{1}{5}$ of the tibiae, and of metatarsi whitish. In some specimens the fore and middle femora and tibiae have a brown ring near or beyond the middle, and the posterior femora are wholly brown. Sometimes the posterior tibiae also have a whitish ring near the tip and the hind tarsi whitish. Halteres white with the tip of the knob sometimes darkened.

Genus 7. Brachypogon Kieffer

Bul. Soc. Ent. Fr. 69. 1899

Belongs to the group Ceratopogon distinguished by having the wings bare, in having media coalesced with R_{4+5}, the branches of the radius coalescent, pulvilli absent. (Pl.17, fig.13). Type Ceratopogon vitiosus Winn. No North American species have thus far been described.

XYLOCRYPTA Kieffer

Genus Xylocrypta Kieffer. Bul. Soc. Ent. Fr. 69. 1899

From the other genera of the group Ceratopogon it is distinguished in having the wings bare, the media simple, and the tarsal claws with teeth. Type species Ceratopogon fasciata Meigen.

Xylocrypta Kieffer is made a synonym of Palpomyia Kieffer by its author (1902). The name may be retained for a group, including species, having a wing of the type shown on pl.17, fig.16, and having femora either with spines (genus Palpomyia) or without (genus Ceratolophus).

Genus 8. Ceratolophus Kieffer

Belongs to the group Ceratopogon. Wings bare; media simple, R_1 and R_5 connected by the crossvein-like R_2 (resembling Palpomyia pl.17, fig.16); femora unarmed.

This name was first given by its author (Kieffer 1899*b*) to a genus characterized thus: The wings are bare, the media simple, the tarsal claws without teeth. Type of the genus is Ceratopogon femoratus Fabr. This species has now been made the type of the subgenus Serromyia (q. v.). In a later paper Kieffer (1902) made Ceratolophus a subgenus of Palpomyia. But since, according to Skuse (1889), Palpomyia has the femora armed, Ceratolophus better be retained as a distinct genus. Several American species.

Ceratolophus sp.

The egg-laying of this species was observed by Professor Needham, Dr. A. D. MacGillivray and the writer in July. The little flies hover in considerable numbers near the rocks over which the spray of Fall creek dashes. Selecting a suitable spot upon the rock, above the surface of the water, but splashed by the spray, the female begins egg-laying. The eggs are laid rapidly, about two per second, until several hundred eggs have been set up on end, side by side in a little clump of about 5 mm. in diameter. Upon a single suitable rock many clumps may be found. The eggs when first deposited are white, but they soon become black. Another species not determined lays a similar clump of eggs on the surface of the pond lily leaves. The larvae which emerge I was unable to distinguish from newly hatched larvae of other species.

Imago. Black, legs paler, length 2 mm. Head subshining black; mouth parts and antennae fuscous, the basal joint of the latter black. Thorax wholly shining black, when viewed obliquely a little pruinose. Abdomen dull black, the first and last joints brownish. Femora yellow, the hind pair brown on the apical half; the fore tibiae yellow, the middle pair pale brown, the hind ones dark brown. All tarsi brown. All legs with few hairs and no prominent setae. Wings hyaline, bare. Halteres black. The crossvein-like R_2 is situated near base of the radial cell. Ithaca, N. Y.

Genus 9. Palpomyia Megerle in litt.

Meigen, Syst. Beschr. 1:65. 1818. Stephens, Catalogue Brit. Dipt. 238. 1829

On page 238 of his Catalogue of British Insects (1829) Stephens affixes this name to all species of Meigen's group B of Cera-

topogon. The name was first published by Meigen as a manuscript name of Megerle's, for a species belonging to the above-mentioned group, a group characterized as having the flexor surface of the fore femora spinose.

Accordingly, and as Skuse (1889) has already stated, Palpomyia may be defined thus: Belongs to the group Ceratopogon; wings bare, with five radial cells, R_2 present; media simple; some or all the femora spinose beneath; pulvilli and empodium wanting.

Kieffer (1902) in his definition for the genus includes also those species whose femora are without setae; but it seems to me that Skuse's interpretation of the genus has the claim of priority, thus leaving Ceratolophus as a distinct genus and using the name Palpomyia for those species having setose femora.

Subgenus 1. Alasion rondani

Dipt. Prodromus. 2:14. 1857. (=Apogon, Prodromus. 1:175. 1856. Preoc.)

In the analytical table Apogon is briefly described as follows: Femora, at least the anterior pair, spinose beneath; antennae of the male verticillate with short hairs as in the female. Spec. typ.; Ceratopogon hortulanus Meigen. On page 14, Prodr. II. '57, Rondani changes the name Apogon to Alasion on account of preoccupation.

C. hortulanus is made a synonym of C. flavipes by later authors. These authors say nothing of the short-haired antennae of the male, and it appears that there is perhaps some error here on Rondani's part. The type species C. flavipes is placed among the Serromyia by Bezzi. This seems unwarranted since the hind femora are not thickened. In the table given by Kieffer (1902) it would fall in the division with Palpomyia.

The name might stand as a subgeneric name as one of the divisions of Palpomyia. It may then be defined as follows: Wings bare, R_2 present, crossvein-like; media simple; some or all the femora spinose beneath, not thickened; the soles (plantae) of the feet hairy, not spinose; in this last character distinguished from Sphaeromyas. Several American species.

Subgenus 2. Sphaeromyas Stephens

Catalogue Brit. Dipt. 236. 1829; Curtis Brit. Ins. 6:285. (Pl.17, fig.16; pl.18, figs. 13, 14)

In the figure given by Curtis the tarsal claws resemble Winnertz's (1852) pl.I, fig.15a, and the wing pl.VIII, fig.63.

Wing bare, five radial cells, R_2 present, crossvein-like; media simple; some or all the femora spinose beneath; terminal joint of the tarsi armed with a double row of spiny bristles, each claw (at least in the female) with a tooth on the inner side. Belongs to group Ceratopogon. Type of the genus C. fasciatus Meigen (=albomarginatus Steph). Several American species.

Sphaeromyas argentatus Loew

1861 Ceratopogon Loew. Berl. Ent. Zeit. 310

The egg-laying of this species was first observed by Professor Needham, by whom my attention was called to it. During the latter days of June and the first of July about sundown the female fly hovers about three or four inches above the water's surface close to the shore in a place sheltered by the shrubs and weeds. With the head pointing toward the shore and the body swaying rhythmically laterally to and fro, the egg-laying begins. The eggs are enclosed in a gelatinous ribbon, placed at right angles to the long axis. A short section of this ribbon with the eggs side by side is shown on pl.31, fig.9. The ribbon when deposited is about 1.5 inches in length, flat, and appears wrinkled like a paraffin ribbon. The lateral swaying of the body at the beginning of the egg-laying is of about one inch amplitude, but as the ribbon of eggs increases, the amplitude decreases until just before deposition it is less than $\frac{1}{2}$ inch. When the egg string is about $\frac{1}{4}$ inch long the fly seizes it with her hind and middle legs, the hind legs guiding, the middle legs paying out the string as its length increases. The fore legs are folded up under the body. This egg-laying process occupies from three to five minutes; when completed the fly suddenly darts down to the water's surface, deposits her eggs and flies away.

The eggs when first laid are whitish, but later, as development progresses, they become brown. Each egg is about 0.4 mm. in length by .07 in width; somewhat pointed at one end and

flattened at the other, the latter with a minute rectangular bolster with knobbed corners.

The larvae emerge in the course of four or five days; a slender, white, snake-like creature, differing in no wise from the full grown Ceratopogon larva excepting that it has a relatively larger head; the posterior end has the usual setae. None were reared to maturity, hence no dissections could be made of the head, nor were any pupae obtained. The imago has been fully described by Loew (1861).

Subgenus 3. Serromyia Megerle in litt.

Meigen Syst. Beschr. 1:66. 1818; Prionomyia Stephens. Cat'l Brit. Ins. 237. 1829; Ceratopogon pt. C. Meigen, Stephens, loc. cit.

The name Serromyia was first published by Meigen as a manuscript name of Megerle's for Ceratopogon femoratus Fabr. Later, in 1829, Stephens places into the Prionomyia all of Meigen's Ceratopogon group C, the members of which have the hind femora thickened, and spinose beneath. According to both Skuse (1889) and Kieffer (1902), the genus may be defined as follows: Wings bare, the crossvein-like R_2 present; hind femora thickened, and spinose beneath. Belongs to the group Ceratopogon. Several North American species.

Subgenus 4. Heteromyia Say

Amer. Ent. 2:79. 1825; and Compl. Wr. 1. (=Pachyleptus Walker. Ins. Saunders Dipt. 426. 1856.)

Heteromyia may be considered as a subgenus of Palpomyia and defined thus: Wings bare, the vein R_2 present, crossvein-like (resembling pl.17, fig.16); media simple; femora spinose beneath, fore femora thickened (pl.37, figs. 8 and 9). Say's description is as follows:

Artificial character. Antennae porrect, filiform, 14-jointed, five terminal joints elongated; palpi exserted, four-jointed; basal joint shortest, a little contracted in the middle; ocelli none; eyes reniform; posterior feet much elongated, slender, and with a single nail at the tip; anterior pair with somewhat elongated coxae, and much dilated femora, armed with a series of short spines on the anterior edge, on which the arcuated tibia closes.

Natural character. Body moderately slender; head small, rounded, flattened before; antennae in the middle of the face; first

joint large, but not long; the eight following joints suboval; the five terminal joints long, not dilated, cylindric, each being twice the length of the preceding ones; eyes reniform, large, wider beneath, and approaching above; stemmata none; palpi arcuated, four-jointed, first joint shortest, last joint longest; proboscis shorter than the head; thorax subglobular, convex above and projecting a little forward acutely before; beneath convex; scutel transverse; wings moderate, somewhat lanceolate; poisers naked; feet unequal; anterior pair with the coxae somewhat elongated; thighs dilated, and with a series of spines on the lower side; tibiae arcuated, accurately closing on the inferior surface of the thigh; tarsi moderate; intermediate pair slender, longer than the anteriors; third pair longest, slender, the tarsi elongated, terminated by a single long and slender nail.

In specimens of Heteromyia fasciata Say, I find the wing has the crossvein-like R_2 though very delicate and indistinct.

Walker's description of Pachyleptus agrees exactly with that of Say. Arribalzaga (1893) redescribes the genus at length for a specimen in his possession. Heteromyia fasciata Say, differs from Arribalzaga's description of Pachyleptus in the following particulars: Face convex and not keeled; the apical joint of the palpus is longer than the second and third, which are subequal; and the hind tarsi which are much elongated have only the first and second joints subequal, the others being shorter. As these differentiating characters are of specific rather than generic importance, I think Pachyleptus should be considered a synonym of Heteromyia.

In one particular only may there be a chance that the two genera are distinct. In Walker's description nothing is said of the wing venation excepting the statement that the veins are like those of Ceratopogon in structure; but Arribalzaga states that R_2 is wanting. This condition agrees with the figure given by Say (pl.37, fig.8). In the type species, however (H. fasciata), this vein is present, at least in all the specimens that I have seen, although it is quite delicate and indistinct. Should it be found that certain species do have this vein and others do not, the former may be called Heteromyia and the latter Pachyleptus Arribalzaga (=Pachyleptus Walker?)

There are several North American species.

Walker's (1856) description is as follows:

Pachyleptus. Nearly allied to Ceratopogon. Body slender; head small, nearly round; palpi moderately long; antennae mutilated; thorax convex; abdomen nearly cylindrical, somewhat contracted towards the base, much more slender than the thorax, and almost twice its length; posterior legs rather long and slender; femora subclavate; fore legs raptorious; femora thick, tibiae slightly curved, closely applied to the femora; wings narrow; veins like those of Ceratopogon in structure.

Ceratopogon sp. sens. lat.

(Pl.18, figs. 1–3)

The larvae were found in Eddy pond, Ithaca N. Y., in April. They are white with brown markings; length 8-9 mm. Head brown; each eye consists of two nearly contagious spots; antennae two-jointed and very short; setae on the head as shown in figure 3. The labrum (fig.1) is rounded, with a pair of jointed and a pair of simple papillae. The mandible is shown in fig.3*m*, the maxilla in fig.2*mx*, the latter has a prominent two-jointed palpus, labium (fig.2*l*) rounded, with three cephalad projecting teeth on the floor of the mouth cavity. The segments of the thorax are marked with brown, the first with three blotches on dorsal surface, the second with two lateral spots, and two longitudinal lines which rise at the anterior margin and extend half the length of the segment, the third with two nearly contiguous spots on each side, and a pair of spots on its anterior margin. Each abdominal segment has a pair of elongate spots at the anterior margin, a dorso-lateral and a ventro-lateral stripe, the latter prolonged anteriorly and joined by a transverse fascia at the incisure; a fine median central stripe is produced forward from the transverse fascia. These stripes vary in length, in some specimens forming almost continuous longitudinal stripes along the abdomen. Setae of caudal end are about eight in number, comparatively small, and arranged not in pairs but singly. Pupa and imago not obtained. Of this species specimens have been kept living in aquaria from October to April.

Ceratopogon sp. sens. lat.

Professor A. S. Packard (1870) published an account of a larva and pupa which belongs to the group of the bare-winged Ceratopogon. It is described as Tanypus sp. to which genus it certainly does not belong. The larva and pupa were found at Clear Lake, Lake county, California. The description states that the caudal end is without bristles or hairs of any

kind. It is said that the pupa has no respiratory appendages, the only peculiarity which would distinguish it from other known species belonging to this group.

Genus Psychophaena Phillipi

Verh. z. b. Ges. Wien. 628. 1865

Proboscis equalling the head in length; palpi four-jointed, third joint thickened, obconate, the fourth a little shorter, slender and cylindrical; antennae pilose, 14-jointed (also of the male?) the first joint thickened, the following seven subglobose and (in the female at least) not petiolate, the rest elongate, the apical one lanceolate; the posterior margin of the wing with long cilia; legs pilose, not spurred, the metatarsus longer than the following joints. The wing venation resembles fig.14, pl.17, but the media separates from R_{4+5} a little distad of the forking of the cubitus, this forking being almost as far distad as the tip of the radial veins. The radial cells short. Type P. pictipennis Phillipi (Chile). This genus as defined does not differ from Ceratopogon or Culicoides.

Genus Tetraphora Phillipi

Verh. z. b. Ges. Wien. 630. 1865. (Pl.37, fig.18)

The antennae equal in length, the head and the thorax taken together, about 12-14 joints, moniliform, verticillate with long hairs, the basal joints subglobose, the intermediate ones narrowed apically, bulbous. Wings hairy, venation as in fig.18. Legs long, the first tarsal joint about as long as the four following. Type T. fusca. Phil. (Chile). From the figure of the wing it appears that this genus is probably a synonym of either Ceratopogon or Culicoides.

Genus Didymorphleps Weyenbergh

Stettiner Ent. Zeit. 44:108. 1883. (Pl.35, fig.25, after Weyenbergh)

The wing venation and other characters as figured and described by Weyenbergh is essentially that of a Ceratopogon or Culicoides, but according to this author is said to present some differentiating characters. The cilia of the anterior wing margin are coarse and bristle-like and of equal length; those of the posterior margin are more delicate and of

unequal length. The entire wing is so thickly covered with microscopic hairs that it appears nearly opaque. There are several peculiarities in the venation to which the author calls attention. The R_{4+5} does not reach the margin; parallel to and above it is a vein (perhaps a fold) which enters the margin; the latter vein is not connected with any vein at its base. Above this is a forked vein (fold) which has no connection at its base. This is absent in the female. This forked vein or fold is of common occurrence in many Ceratopogon wings. Upon each side of the cubitus there is a vein (probably a fold) running parallel to it. These folds are absent in the female. The halteres have prominent knobs. According to the text (but not the figure) the vein which enters the anterior wing margin before the mid-length of the wing has a point of contact with the bend of the one which enters the anterior margin a little distad of the middle. The legs and antennae are like those of Ceratopogon. In regard to the male antennae the author says: "Das 2te Glied diese Fühler hat der langen Haarbusch welcher Ceratopogon kennzeichnet, aber an der Spitze ist es so zu sagen gaffelig frisert und seine Innenseite nicht so glatt wie die Aussenseite, weil erstere kleine borstige Haare zeigt welche ein wenig vorragen."

Each joint of the antennae of the female possesses four long hairs, each hair about as long as the antenna.

Type of the genus D. hortorum Weyenbergh, l. c.

It does not appear that the venation differs materially from some species of Ceratopogon. Compare the wing of C. rostratus Winn., pl.IV, fig.23, Winnertz (1852). The other characters given certainly do not distinguish it, and therefore this genus must be considered as a synonym of either Ceratopogon or Culicoides.

Genus 10. Belgica Jacobs

Ann. de Soc. Belgique. 106. 1900

The head somewhat rounded, longer than high, a little wider than the thorax. Face flat, the eyes not emarginate, placed at half the hight of the face, "eyes not smooth." Antennae inserted opposite the eyes, a little lower than their transverse

diameter, with five distinct and separated joints; the first joint short, cylindrical, cut obliquely from without to within, the last joint as long as the third and fourth together, with truncated base and rounded tip. The antennal joints are provided with hairs, the last with longer and stouter ones. The fifth joint in certain specimens appears to have a suggestion of a division simulating a sixth joint. The epistome is prolonged, triangular, and truncate. The palpi not more slender than the antennae, have four joints, the last joint being one-half as long as the one preceding. The thorax is produced over the head, the humeri are prominent, the center of the thorax is arched, and widens out to the abdomen. The scutellum is triangular with truncated apex. Legs.—Anterior coxae are prominent, first pair is somewhat separated from the following pair, the femora are compressed and widened; the tarsal claws with a little subapical tooth and two pulvilli. The wings are stumpy, in the form of a flattened racket, more or less developed according to the specimen. Halteres are wanting. The abdomen is 8-segmented; in the male it terminates ventrally with a large plate carrying two lamellae covering the genitalia; with the female these organs are hidden in the abdomen. Translation from the original. The genus was erected for two Patagonian species, B. antarctica and B. magellanica.

Genus 11. Eretmoptera Kellogg

Biol. Bul. 1:82. (Pl.35, figs. 15 to 24)

Under this name Professor Kellogg published a description of a maritime fly which bears such a resemblance to the genus Psamathiomyia Deby that I at first considered them synonymous. There appear to be, however, several characters which may be of sufficient importance to separate them generically. In Eretmoptera the maxillary palpi are four-segmented, while in Psamathiomyia they are two-jointed; the female of the former has four-jointed antennae, while both sexes of the latter have six-jointed antennae. The remaining distinctive characters seem to be of specific rather than of generic value. The flies were collected December 27, 1898, by Mr J. C. Brown at Point Lobos, a rocky point on the Pacific

coast near Monterey, California. The flies, of which there were many, were resting or running on the surface of the ocean water of the tide pools, and had a tendency to gather in large numbers in "patches" and "in ball like masses" on the surface of the water. None were seen below the surface, nor were any seen flying. They moved about on the surface of the water very rapidly. The following is a description given by Professor Kellogg, of the species:

Eretmoptera browni Kellogg

Biol. Bul. 82. 1900

Male (fig.21). Length 2 mm. Head slightly broader than the thorax, eyes widely separated, very small, very convex, hairy, and with rather large facets; ocelli absent; antennae (fig.22) short, length 3 mm.; six-segmented, the basal segments wide and globose, the sixth segment longest, the second next, the third and fifth about equal, the fourth shortest, with a few short strong hairs on each segment; and the surface everywhere with a fine stiff pubescence. The mouth parts are of simple Nematocerous type, short, and with distinct labrum-epipharynx, maxillae, hypopharynx, and labium; mandibles absent; labrum-epipharynx (fig.19) short, broadly triangular, with obtusely rounded tip. Maxillae with short, weak, tapering, pointed lobe, and 4-segmented palpi, 3 mm. long; the palpi with the last two segments longest and equal, and all the segments provided like the antennae with a few short stray hairs and a fine stiff pubescence (fig.16); hypopharynx (fig.18) elongate, triangular, as long as the labrum-epipharynx, but narrower and more acute; labium (fig.17) short, lip-like, with free paraglossae, without pseudotracheae. The face is whitish with a median longitudinal dark line, and the antennary fossae with dark margins; the basal segment of the antenna is rather dark, the other segments pale. Thorax without bristles, dark above, pale beneath. Legs long and slender, whitish with blackish joints: middle and hind legs longest and equal, front legs only a little shorter; average measurement of middle leg, femur 1 mm., tibia 1 mm., tarsus 1 mm.; tarsus 5-segmented, segment one as long as segment two, three and four together; segment five slightly longer that segment four; tibiae of all legs with a single apical spur; tarsal claws strongly curved, thickened at base, with three delicate spines on basal half; no pulvilli; empodium (fig.15 emp.) rather long, curving, filiform, and plumose or pectinate for its whole length. Wings narrow, strap-like, extending only to fourth abdominal segment, length .75 mm., and wholly without veins; whitish, somewhat wrinkled,

and finely spinulose (fig.21). These strange veinless wings are not especially thin or delicate, but on the contrary are rather thickened, the costal margin being especially thickened and perhaps folded. The halteres (fig.20) or the structures which occupy the usual position of the halteres, are not of the usual pedicel and knobbed type common among Diptera, but are minute lobe or scale-like processes, appearing like rudiments of metathoracic wings; like the mesothoracic wings, they are rather thickened and finely spinulose; they are widest at the base and taper to a rounded tip; they average .08 mm. in length. Abdomen with nine segments, tapering gradually posteriorly; mottled blackish and gray above, lighter below, palest laterally; a few scattered, small, wholly inconspicuous hairs, the body appearing glabrous; external genitalia consisting of a pair of large, conspicuous, strong, articulated claspers (fig.24) which are covered with a pubescence.

Female. Length 2.5 mm., thus being ¼ longer than the male; this extra length is all in the abdomen, which is markedly larger than the abdomen of the male in every way. The head and thorax are narrower than the robust abdomen, which is subcylindrical, tapering only slightly posteriorly. Eyes as in the male very small, very widely separated, and hairy. Antennae only 4-segmented. Mouth parts essentially as in the male, with, however, appreciable differences in shape; the labrum-epipharynx is narrower at base, and is more pointed apically; the labium with paraglossae separated farther back and slightly narrower. The reduced wings and halteres like those of the male, the wings' length .85 mm., slightly elongated. The abdomen consists of nine segments mottled blackish, with conspicuous white sutural spaces, caused by the distension of the abdomen. The external genitalia are inconspicuous. There is a short, emarginate dorsal plate with rounded tips and a pair of lateral processes. There appears to be no extrusible ovipositor.

Pupa of female. A single pupa taken with the imagines from a tide pool. Length 2.5 mm. Immediately recognizable as pupa of the female from the similarity in size, shape and markings. Abdomen just as in the adult in regard to size, shape, color and markings. The antennae, legs and wings are folded on the lateral and ventral aspects of the anterior part of the body, and extending backwards to (hardly reaching) the posterior margin of the second abdominal segment. There are no external tracheal gills or elongated spiracles (breathing tubes). There are no bristles nor special clinging organs. The pupa is of a very simple, unmodified, unprotected type.

Genus 12. Halirytus Eaton

Ent. Mo. Mag. 12:60. 1875. (Pl.37, figs. 5, 6, 7)

Imago, female. Head suborbicular, palpi very short, two-jointed; antennae divergent, six-jointed, the basal joint very large, nearly orbicular, the next four much smaller, submoniliform, the apical joint oval, about as long as the preceding two together; the basal joint has one rather short and a few still shorter bristles near its middle, and the apical joint has a short bristle on one side, and a finer hair on the other side near its base, and some extremely minute pubescence, which is hardly discernible even under the microscope (fig.7); genae each with one minute bristle below the eye; epistome scutiform; eyes suborbicular, protuberant, close to their upper orbit behind are three short bristles, the hinder two are near together; ocelli absent. Mesonotum somewhat cucullate, being strongly arched in front and projecting forwards above the head; scutellum semi-elliptical, prominent, with a transverse line of minute erect bristles; metanotum very transverse, exceedingly short; the spiracles on each side of the mesothorax are very prominent; wings rudimentary, somewhat narrowly obovate, reaching to the apex of the first abdominal segment; halteres small, clavate and slender; legs very long, the posterior tibiae not thickened nor spurred; the proximal joints of the tarsi very long, ungues and pulvilli very small. Abdomen with seven dorsal and six ventral segments (exclusive of the base supporting the valves of the ovipositor), subcylindric; ovipositor pointed obliquely downwards, composed of a stout basal joint terminated by a pair of acute short lanceolate lamellae enclosing a smaller pair of spicules. Male unknown.

The larvae probably feed on Enteromorpha. The species is found on the Kerguelen Island. Type of genus is H. amphibius, Eaton.

This genus is akin to Corynoneura, from which it is separated by its two-jointed palpi, the comparative nakedness of its antennae, its entire eyes, the spurless tibiae of which the hind pair is not thickened, its rudimentary wings, and perhaps by the number of abdominal segments. If the portion reckoned above as the base of the ovipositor be regarded as a segment, then there is no difference between these genera in that last particular.

All the known species of Corynoneura are extremely minute. In the original diagnosis the number of the segments was said to be five; they were enumerated from below, and the proximal segment was taken to be metathoracic.

The foregoing description is taken from Verrall's article in Phil. Trans. of the Royal Soc. of London, vol. 168, p.246. The figures on pl.37 are also copied from Verrall. No North American species.

Genus 13. Psamathiomyia Deby

Journ. Royl. Micr. Soc. 180. 1889. (Pl.35, figs. 4 to 9)

This genus was erected for a small Dipteron found in abundance during the latter days of April, 1888, at Biarritz in the south of France. The following is an abstract of Mr Deby's paper:

Psamathiomyia pectinata is a marine insect, living below water during its early existence, the larva feeding on Enteromorpha. The adult escapes from the pupal case while the descending tide has laid bare the algae covered rocks; these small insects swarm at such times, being especially active when the sun shines on them. The males are more numerous than the females, and are also much more rapid in their motions. . . . Both sexes have rudimentary wings, quite useless as organs of flight, so that these insects cannot possibly escape from the rising tide, which on this coast is accompanied by heavy surf and breakers. It is presumed that the life of the imago does not exceed the few hours during which the tide has receded. Several specimens which were immerged in a vial of sea water were immediately drowned. These insects being small have to be looked for with attention, but once discovered they are easily recognized; the black, very long-legged males look like minute spiders, while the dingy brown louse-like females, which they drag after them, have the appearance, from a distance, of the cocoons some spiders carry behind them.

Generic characters. Antennae (fig.6) six-jointed in both sexes, three middle joints submoniliform, neither feathered nor plumed, much shorter than the thorax and head; mesonotum (fig.9) cucullate, projecting over the head; legs very long and slender, especially in the males, the terminal joint of the tarsus being

furnished (along with the usual claws) with a special finger-like projection, extending over and between the claws, while a doubly curved curious comb-like appendage faces it from below (pl.35, fig.8).

Wings rudimentary (figs.4 and 5); much smaller in the females than in the males; wings without nervures. Halteres distinct (fig.7). The convex eyes are distant in both sexes but fartherest apart in the females. Both the claws on the end of the tarsi of the male are deeply cleft or bifid (fig.8), those of the female being simple. The comb-like appendages are similar in both sexes.

The external genitalia of the male consist of a powerful two-jointed pair of forceps, the lower joints of which are large, massive, subglobular, while the terminal joints are small and linear, and so articulated to the first as to curve inwardly between them when not in use. These terminal joints of the forceps carry at their tips an armature of short, sharp, scattered, horny spines. The ovipositor of the female is conical, narrowing towards the acute apex; it is constituted of two lateral plates or valves, which cover and protect two very delicate, parallel, acute, membranous spiculae.

Mr Deby further gives an extended description of the species, and a plate of eleven figures showing details of structure. The figures of the wings, the thorax, and the foot of the male are here reproduced on pl.35.

Of the remaining figures, that of the male forceps is like that of Eretmoptera browni Kellogg, shown in fig.24, pl.35, excepting that the basal joint of the latter is somewhat longer; and the legs of the male of Psamathiomyia are shown as being proportionately longer than in the American species. Of the structural specific characters the following are of especial importance. The eyes are prominent and convex; the facets are large and hemispherical; the ocelli are absent. Each eye carries at its posterior lateral edge a black chitinous appendage of an oblong shape and of unknown use. The palpi are conspicuous, two-jointed, the terminal joint rich in sensory bristles. The empodium of both sexes is deeply fringed by a series of lengthened simple as well as forked or bifid teeth upon its outer edge, while its inner edge is quite smooth. The tergites of the

abdomen in both sexes number eight. Length of the male about 4 mm.; of the female 4.5 mm.

The larva. The larva of Psamathiomyia is linear, vermiform, and of a yellow color. The apparent number of segments of the body, including the head, is twelve, one for the head, three for the thorax, and eight for the abdomen. The thoracic segments are shorter than the following; the apical one, into which the head is retractile, being the smallest. The thoracic anterior inferior angles of the somites carry inconspicuous minute bristly tubercles, while the abdominal segments, with the exception of the first and of the anal segment, are supplied in the same place with prominent rounded elevations or cushions which infringe on the anterior edge of the preceding segment. These appendages carry nine to ten parallel rows of very minute dark colored teeth, giving them the resemblance to microscopic currycombs. In front of each row of these teeth and standing at some distance one much stouter spine is visible. The anal segment terminates in five conical and somewhat incurved fleshy appendages, one of which is ventral and much larger and broader than the others. This appendage carries near its apex a large bunch of short-curved bristles, while those opposed to it bear several tufts of similar bristles, and the intermediate appendages are quite glabrous. The total length of this larva is 5.10 mm. The length of the anal segment, including its appendages, is .66 mm., that of the three thoracic segments .66 mm., while the middle segments of the abdomen measure .45 mm. in length by .90 mm. in width. The chitinous mandibles are distinctly visible; they appear, as far as can be made out, to be widely three-lobed or toothed, and to be in communication with two long internal chitinous rods, with slightly swollen heads, which terminate as far back as the last thoracic segment.

Pupa of the male. The pupa case, after the imago has escaped through a dorsal slit in the mesonotum, shows distinctly the three sternal divisions of the thorax, as well as the various segments of the abdomen. These are eight in number, unless the anal terminal process is considered as a segment, in which case the abdomen has nine segments. The sheaths of the legs are quite free, bag-shaped, distinctly jointed, rounded at the ends.

The hinder ones are convolute. The mesonotum shows a median transverse depression. The total length of the pupa is 4.5 mm.

Genus 14. Clunio Haliday

Natural History Review II, Proc. 62. 1855. (Pl.36, figs. 11, 12, 13)

Small ferruginous species, characterized by their one-jointed palpi and rudimentary proboscis.

The head is rounded and placed low; proboscis rudimentary, the palpi one-jointed. Antennae 11-jointed, the first two joints spherical, the third much elongated, the following rounded, scarcely hairy, the last joint quite long. Front broad at the vertex with a small protuberance; ocelli wanting or at least rudimentary; eyes round, somewhat hairy; mesonotum oval, overhanging the head, no transverse suture; scutellum semicircular; the metanotum moderately large. Abdomen shorter than the thorax, the segments crowded together, the last one broadened; the genitalia longer than the rest of the abdomen. Legs moderately long, anterior pair widely separated from the others; tibiae with a spur; the metatarsus elongated, the fourth joint smallest; claws and pulvilli well developed. Halteres leaf-like. Wings comparatively large, anal angle prominent. The venation of the type shown in the figure.

According to the Abbe Kieffer (1898 p.107, footnote), the figure of Haliday and here reproduced is not entirely complete. He says, "Le dessin de Haliday ne représente par la premiere ni la derniere nervure; en outre le rameau inferieur de là 4e fait un angle aigne avec le rameau superieur. . . ."

Of the female and of the life history the following is given by G. H. Carpenter (1894) p.129.

We discovered quite a colony of Clunio marinus Haliday on a mass of green sea-weed (Cladophora) covering a rock which had been left exposed by the tide. On some of the weed with the insects upon it being placed in a tube and examined, it became clear that we had now secured both sexes, for two of the males were carrying about with them (attached *in cop.*) wingless females. These when captured had their abdomens distended with eggs, and appeared of a dull greenish color. The female Clunio is much degraded (fig.13). Not only are the wings reduced to very small vestiges, but the legs are weaker,

and the antennae are shorter and of fewer joints (7) than are those of the male (whose antennae are 11-jointed). The male, by means of his strong claspers (so marked a character of the species), was able to hold the body of the female out in a straight line with his own, and thus carry her about; so that when he walked on the glass of the tube her legs could be seen kicking freely in the air.

During the next day each of the females laid about seventy eggs, enclosed like those of Chironomus in a gelatinous tube. The egg is narrowly spindle-shaped, and measures 0.16 mm. in length. By the morning of the second day egg-laying seemed to have finished, and the body of the mother became much shrivelled up. As in both sexes the mouth parts are vestigial, it is probable that life in the imaginal state is short.

Further examination of the Cladophora revealed a larva of the Chironomid type, which there can be little doubt is that of Clunio (fig.11). This larva (4 mm. long) is, excepting the head, which is brown, of a green color, closely agreeing with the sea-weed on which it feeds and lives. The head bears two deep black ocelli on each side (the posterior much larger than the anterior) and a pair of two-jointed antennae. The mandibles are powerful, armed with teeth, and articulated so as to move in almost vertical planes, though somewhat inclined inwards. They act, in conjunction with the serrated labial plate, as scissor-like cutters. There are twelve body segments, the first and last of which are each provided with a pair of sucker feet, the anterior pair armed with numerous spines, and the posterior with a few hooks. This larva has not the ribbon-like appendages and special breathing processes found in that of Chironomus. Chevrel (1894) states that the female has no halteres; that the labium of the larva has six or eight teeth, and that the last abdominal segment of larva has two long divergent setae. No North American species have been recorded.

GROUP TANYPUS

Tanypus Meigen. Illiger's Mag. 2:261. 1803

This group includes the genera Procladius, Anatopynia, Ablabesmyia, Isoplastus, Tanypus and probably also Pentaneura, Podonomus, and Heptagyia.

Eggs. The egg masses of the group Tanypus doubtless vary as much in form and manner of deposition as do those of Chironomus. The eggs of one species of Tanypus are described by Hammond (Postal Microscopical Journal) as circular gelatinous masses, adhering to floating objects. The eggs are arranged in double rows, along about eight straight and parallel lines which extend across the disk (pl.31, fig.11). I have caught female specimens of a species of Tanypus (A. monilis) while laying eggs and found still attached to the abdomen a string of eggs, resembling that of Ceratopogon (Sphaeromyas) argentata. From an examination of the dried egg strings it appears that in this species the eggs are arranged transversely, the egg string being about 1.5 inches in length.

Larva. All the species of this group agree, as far as I am aware, in having an elongate cylindrical body, a more or less elongate head, a somewhat enlarged thorax and distinctly marked abdominal segments, to the last of which are attached the legs. The head in some species is narrow and slender, over twice as long as wide, and in others less than 1.5 times as long as wide. The eye spots are situated on the sides of the head a little cephalad of the middle. The antennae are more or less elongate, in some species quite long and slender, in others short and stout, varying in length from less than 1.5 to over three times as long as the mandibles. The basal joint ranges from two-thirds to nine-tenths of the entire length; the second joint is usually slender, the third and fourth very minute. At the apex of the first joint (at the base of the second joint) is a slender process nearly or quite as long as the second joint. The antennae are retractile to about the apex of the long basal joint, extending back into sockets in the head. They are retracted by special muscles, and extended again by blood pressure. Meinert (1882) was the first to call attention to the retractile antennae of Tanypus larvae. The labrum is broad, truncate in front, smooth on the dorsal surface, the under surface delicately haired. In some species I have observed several pairs of very slender jointed appendages (pl.20, fig.6). I have discovered no part which is comparable to the epipharynx in Chironomus.

The mandibles are rather broad at the base, considerably curved and prolonged into a long apical tooth, the mesal teeth being short and sometimes indistinct or wanting. The maxilla consists of a broad, more or less square, fleshy process, with hairs or filaments projecting cephalad and mesad (pl.19, fig.1 *mx.*), and a prominent palpus (p) with a short basal joint. The palpus is provided with several papillae or apical processes.

The hypopharynx consists either of a horseshoe-shaped piece having a toothed margin (pl.20, figs. 1h and 6h), excepting the middle section, or of two curved pectinate pieces, their tips nearly touching each other; besides this there is a pointed slender lobe (figs.1x and 6x) on each side of the labium. The labium usually has five, though sometimes but four, marginal teeth, differing slightly in shape in the different species. The thorax is somewhat larger in diameter than the abdominal segments, and its three segments not so sharply separated. The anterior prolegs are quite long and slender. They have a long common base, and two branches, at the ends of which protrude the retractile claws. These claws are comparatively few in number, quite distinct, and not hair-like like those of Chironomus. The abdomen has nine segments and is in some species provided with lateral cilia. To the last segment of the abdomen are attached the abdominal legs and appendages (pl.19, fig.10). On the dorsal surface, and attached to the posterior margin of the ninth segment, are two moderately slender cylindrical processes, about three times as long as wide, each with a crown of six or eight long setae at the tip; between the posterior legs is a pair of pointed blood gills (b), and immediately dorsad of this pair is another pair. Often also there is a pair of long setae dorsad of the upper pair of blood gills. The anal feet are long and stilt-like, Degeer comparing them to wooden legs. The claws are slender, each usually with a basal tooth (pl.19, figs. 11 and 12), and are retractile. Blood worms are greedily devoured by Tanypus larvae. The alimentary canal has a reddish tinge, which suggests that the larva preys upon the small red worms known as Tubipex or some other small creature which contains haemoglobin in its blood. Crustacea actually have been seen alive in the alimentary canal. The tracheal system is better developed than in Chironomus

larvae; but it does not appear to open to the surface. (Miall and Hammond, 1900.) Tanypus larvae are said to make tubes like those of Chironomus, but in captivity they seldom seem to do so.

Pupa. Greatly resembles that of Culex, but differs in the form of the breathing trumpet, the form of the caudal fin, and in lacking the stellate hairs on the posterior margin of the thorax. It often remains below the surface but can come up to breathe. When alarmed it sinks and often holds on to objects at the bottom of the water by means of its tail. The pupa is further provided with suckers on the abdomen, which enables it to hold on to solid objects. Meinert (1886) says that the suckers are circular depressions outside the dorsal shields of the abdomen. The pupa of Tanypus varius shows them most distinctly. Here they are borne in pairs by four abdominal segments (3-6). When the pupa has attached itself by a single sucker, it can turn about without losing its hold. The form of the pupa is shown on pl.19, fig.8. The thorax is large and bulky, the abdomen slender and curved under the thorax. The breathing trumpets vary in the different species (figs. 2, 3, 7, 13, and 18); in some species they are long, slender, cylindrical, and tube-like; in others spindle-shaped or funnel-shaped; and in one an elongate ellipsoid with a small aperture. The surface may be smooth, spinose, or reticulate. On the dorsum of the thorax back of the trumpets there is, in some species at least, a row of short spines (pl.19, fig.8). The wings, legs, antennae and eyes of the adult are distinctly visible in the more mature pupae. There are seven abdominal segments besides the anal to which the caudal fin is attached. There are no distinct spinose markings in the species which I have examined. The caudal fin varies with the different species; in some it is composed of two pointed projections, in others these are more lobe-like, while in an extreme form it is in the form of a rounded paddle (pl.19, figs. 4, 6, 15, 19, and pl.20, figs. 4 and 8).

The imago. Body elongate and pubescent. Eyes separate in both sexes. Palpi four-jointed, curved, first joint shorter than the second, second shorter than the third, fourth nearly as long as the second and third. Antennae in both sexes fifteen-jointed, filiform, seated in a notch in the eyes; plumose in the male, joints two to thirteen very small, fourteenth long, fifteenth short and

conical; in the female the antennae are pilose, the fifteenth thicker than the others, pubescent and more acuminate. Thorax elevated, with a depression in front of the scutellum, scutellum rather small; metathorax with a longitudinal furrow. Abdomen composed of eight segments, long, hairy; more hairy and longer in the male than in the female. Wings often pubescent, hairy along the hind border, the subcostal vein ending beyond the middle of the wing, vein R_1 ending about two thirds the length; vein R_{2+3} emerging from the crossvein and the lower branch (R_3) ending at beyond three fourths the length; vein R_{4+5} also proceeding from the crossvein, ending a very little in front of the tip; cubitus forked as usual, the M-Cu crossvein present. Legs long and slender, pubescent, unarmed; coxae of moderate size, claws very small; in the male the fore tarsi are often pilose, in the female always bare.

The group Tanypus which is equivalent to the genus of Meigen (1803) has been divided by Skuse (1889) into three genera, Procladius, Isoplastus, and Tanypus sens. str. Skuse proposed to retain the name Tanypus for those species in which the wings are hairy, and in which the fork of the cubitus is proximad of the M-Cu crossvein. This cannot well be maintained since Meigen (1803) gives cinctus Fabr. (=punctipennis Meig.) as the type species, and it possesses hairy wings and the fork of the cubitus distad of this crossvein (i. e. petiolate). I therefore suggest retaining the name Tanypus for the last-mentioned division and propose the name of Ablabesmyia for the former. Skuse has already provided for the bare-winged species with the fork of the cubitus petiolate the name Procladius. Isoplastus applies to an Australian genus. There remain still the species having bare wings with fork of the cubitus proximad of crossvein, for which I propose the name of Anatopynia. These new genera will be more fully characterized farther on.

Genus 15. Procladius Skuse

Proc. Linn. Soc. N. S. W. 4:283. 1889
Tanypus Meigen, pt. 1803

Antennae in the male 15-jointed. Wings naked. R_2 and R_3 distinct. Fork of the cubitus short, its base lying midway between the M-Cu crossvein and the tip of its posterior branch

(pl.37, fig.12). In some species petiole of the cubitus is very short (pl.27, fig.4).

The only larva which I have found belonging to this genus is that of a d u m b r a t u s n. sp. (pl.20, figs.1-5). Pupae of the above species and of P. p i n g u i s Lw. will be found described upon a subsequent page (pl.19, figs.3-4, and pl.20, figs. 4 and 5).

KEY TO SPECIES OF PROCLADIUS

Imagines

a Legs uniform in color, pale or dark

b Legs piceous or brownish; fore metatarsus about one sixth shorter than the tibia; opaque black species, thorax cinereous, black striped; crossvein lightly cinereous; wings white; halteres white; length 4.5 mm. ..... 1. t u r p i s Zett.

bb Legs yellow; brown species, prothorax, a spot near its humerus and scutellum dark yellow; length 4.5 mm. (Colorado) 2. o c c i d e n t a l i s

aa Legs bicolored

b Yellow or red dorsum of thorax (usually pale species)

c Scutellum and metanotum yellow, the latter sometimes with a line of black

d Small yellowish species; thorax whitish with three shining reddish stripes; length 1.5 to 2.25 mm. ..... 3. p u s i l l u s

dd Larger yellow species, 3 mm. ..... 4. b e l l u s

cc Scutellum and metanotum, either one or both, with considerable black upon them

d Tips of fore femora black; abdomen black and fusous; male, length 4.5 mm. ..... 5. t h o r a c i c u s

dd Fore femora not as above

e Fore femora wholly yellow; abdomen yellow; segments with black bases; female, length 3 mm. ..... 6. c o n c i n n u s

ee Fore femora black and yellow

f Femora black, bases yellow; male abdomen black and white; female abdomen black; male fore tibia white with black tip; female fore tibia black; length 3 mm. (Cuba) 7. h u m e r a l i s

ff Femora and tibiae yellow, each with two black rings; abdomen black and yellow; female, length 3.5 mm. 8. t r i c o l o r

bb Black or fuscous dorsum of thorax (dark species)

c Femora more than half yellow

d Abdomen wholly dark brown subshining; thorax shining brown, with three shining dark brown stripes; tibiae nearly wholly brown; halteres sordidly yellow; female, length 3.5 to 4 mm. 9. c a l i g i n o s u s n. sp.

dd Each abdominal segment basally or apically yellow

e Thorax pitchy black; pleura ferruginous; abdomen black; bases of segments yellow; male, 3 mm. ..... 10. f l a v i c i n c t u s

ee Thorax and pleura with three wide dull dark brown or black stripes; abdomen brown, each segment with a yellowish posterior margin; length 2.5 mm.; female
11. a d u m b r a t u s n. sp.

cc Fore femur black, excepting the immediate base

d Middle femora yellow; abdomen shining black; female, length 3.3 mm. ..... 12. p i n g u i s

dd All femora black with white bases; thorax black; pleura with upper half white; female abdomen black; male abdomen white and black ..... 13. s c a p u l a r i s

1. Tanypus (Procladius?) turpis Zetterstedt

1838 C h i r o n o m u s Zett. Ins. Lappon. 811
1850 T a n y p u s Zett. Dipt. Scand. IX. 3596

Dusky cinereous, opaque, dorsum of thorax with three black stripes; antennae brown; wings and halteres white, the crossvein fuscous; legs brown; the fore tarsus of the male short pubescent, its metatarsus about one sixth shorter than the tibia. Length of male 5 mm; female 4 mm.

Male and female. Head dark. Antennae of the male brown, paler at the tip; that of the female yellow with a brown apex. Thorax cinereous, with three rather wide blackish stripes, the median one abbreviated posteriorly and continued by a fine dark line to the cinereous scutellum; metathorax blackish.

Abdomen black, that of the male slender, pilose, the last three segments with little wider pale margins, the caudal appendages small, slender, and incurved; in the female the abdomen is a little stouter and pubescent. Wings white, bare, the anterior veins subtestaceous, the remaining veins slender and white, the oblique R-M crossvein subfuscous; the perpendicular M-Cu crossvein is slender and spotless. Legs rather slender, wholly brown or pale, slightly pubescent. Fore tarsus a little shorter than the tibia, the second tarsal joint one half as long as the metatarsus, the remaining joints gradually decreasing in length. (This species may possibly belong to the genus A n a t o p y n i a.) Greenland, New Jersey (Johnson, 1904).

2. Procladius occidentalis Coquillett

1902 T a n y p u s Coq. Proc. Nat. Museum. 25:92

Brown, the prothorax, a spot near each humerus, and the scutellum dark yellow, legs light yellow, halteres whitish; hairs of antennae brown and yellow, wings hyaline, bare, first vein not connected with the second by a crossvein (i. e. R_2 and R_3 coalescent); fifth vein (cubitus) forks a short distance beyond the crossvein, the latter situated nearly its length before the small crossvein; length 4.5 mm. A male specimen. Colorado, New Jersey (Johnson, 1904).

3. Procladius pusillus Loew

1866 Tanypus Lw. Berl. Ent. Zeit. 4

Male and female. Very pale yellow, the thoracic stripes and the metanotum ochreous red, each abdominal segment with a fuscous basal fascia, wanting or indistinct in the female, the legs white, the extreme tips of the tibiae and the apical ends of the tarsi black, the fourth tarsal joint simple, wings bare, subhyaline, the crossvein subfuscous. Length 1.5 to 2.3 mm. Wing 1.5 to 1.8 mm. Much resembles T. bellus, but is paler and smaller.

The head is pale, the disk of the occiput red, antennae fuscous, in the female with pale base; in the male the hairs subfuscous. Thorax pale yellow, with three red stripes, the median one posteriorly much abbreviated and often divided by a fine line, lateral ones much abbreviated anteriorly. Metanotum and the upper half of the pleura red; the pleura are sometimes wholly red. Scutellum yellowish. Abdomen of the male whitish, each segment with a fuscous basal ring; the abdomen of the female is sometimes wholly white or pale yellow, sometimes with lateral subfuscous spots, rarely each segment with a subfuscous ring. The legs are white, short pilose, extreme tips of tibiae black, the tarsi marked like P. bellus Halteres white. Wings bare, subhyaline transverse vein subfuscous or fuscous. Washington D. C. (Pl.27, fig.1).

To the above description may be added that the tips of two or three joints of the tarsi are blackish, the fourth and fifth tarsal joints infuscated. Fore metatarsus about one-third shorter than its tibia. Specimens from Ithaca, N. Y. Michigan.

4. Procladius bellus Loew

1866 Tanypus Lw. Berl. Ent. Zeit. 4

Male and female. Pallidly yellow, the thoracic stripes and the metanotum reddish, pleura and pectus red and fuscous variegated, the abdomen black annulate, the tarsi towards the tip, and the extreme tips of the tibiae black, the next to the last tarsal joint normal, the wings bare, subhyaline, the transverse veins fuscous. Length 2.7 to 3 mm. Wings 2.5 to 2.7 mm.

The head pale or dilutely clay yellow, the disk of the occiput ferruginous, the antennae of the female pallid, blackish towards the tip, that of the male subfuscous, with basal and apical joints black, with pale pile. Dorsum of thorax pallidly yellow, with three reddish stripes, the median one much abbreviated posteriorly and divided by a very slender pale line; the lateral stripes much abbreviated anteriorly. Scutellum pallidly yellow. Metanotum reddish or ferruginous, often marked with a fuscous

median line. Pleura variegated reddish and fuscous. Abdomen pallid, each segment with a black or fuscous basal fascia, wider on the more posterior segments. The legs covered with whitish or pale yellow pile; the extreme tips of the tibiae are black; the first pair of tarsi are black from the tip of the metatarsus onwards, the base, however, of the second joint in the male being pallid; the second and third pairs have pale first and second joints excepting the extreme tips; the remaining joints are black, though in the male the base of the third joint is pale. The fourth tarsal joints are all simple and sublinear. Halteres white. Wings bare, subhyaline, crossveins fuscous or black. Washington D. C. (Loew.) Fork of cubitus petiolate. (S. Henshaw, in litt.)

5. Procladius thoracicus Loew.

1866 Tanypus Lw. Berl. Ent. Zeit. 4

Male. Reddish, shining, flagellum of the antenna, scutellum, and abdomen, excepting the base of each segment, black fuscous, the legs yellowish, the tip of each tibia and each tarsus, excepting the base, black, the fourth joint of the latter short, that of the middle and hind pairs obcordate, the wings bare, subhyaline, the crossveins fuscous. Length 4.5 mm. Wing 3 mm.

Head yellowish red, the first joint of the antenna the same color or dusky red, the flagellum and its hairs fuscous. Thorax reddish, shining, the color of the humeri verging upon yellow, the scutellum blackish fuscous, the metanotum reddish or subfuscous. Each segment of the abdomen with fuscous black unevenly distributed, so that often they are wholly black excepting the basal joints. The legs are pale yellow, the extreme tips of the fore femora and of all the tibiae are black, the fore tarsi have the last four joints and the apical third of the first joint black; the middle and hind tarsi from the tip of the second joint are black; all the fourth tarsal joints are short, those of the second and third pair of legs are obcordate. Halteres white. Wings bare, subhyaline, crossveins fuscous. Washington, D. C. (Loew.) Fork of cubitus petiolate. (S. Henshaw, in litt.)

6. Procladius concinnus Coquillett

1895 Tanypus Coq. Proc. Acad. Nat. Sc. Phil. 308

Light yellow, three vittae on the thorax reddish yellow, the middle one bordered each side with black, the lateral ones changing into black posteriorly; a dot at each front angle of the scutellum, middle of metanotum, a fascia at base of each abdominal segment except the first, apices of tibiae, of metatarsi, of the second joint of middle and hind tarsi, the whole of the remaining joints and the last four of the front tarsi black.

Penultimate joint of hind tarsi obcordate, as broad as long. Wings naked, whitish hyaline, veins pale yellowish, small crossvein clouded with brown, first vein forked before its apex, the fifth (cubitus) forking slightly beyond the crossvein. Length 3 mm. Female. Tick Island, Florida.

7. Procladius humeralis Loew

1866 Tanypus Lw. Berl. Ent. Zeit. 3

Male and female. Reddish, the humeri and the upper half of the pleura white, the pectus and metanotum fuscous, the legs white and black variegated, the wings bare, with a central black spot which covers the crossveins, the penultimate tarsal joint short, obcordate.

Male. The abdomen white and black ringed, the fore tibiae white except the tip.

Female. The abdomen wholly black, the fore tibiae wholly black. Length 2.7 mm. to 3.3 mm. Wing 2.5 to 2.7 mm.

Head white, the disk of the occiput fuscous. The antennae fuscous, of which the flagellum of the male is paler. The thorax red, in the male opaque, in the female somewhat shining and often more deeply colored; the collar, humeri and upper half of the pleura in both sexes white, though the color is less pure in the female. The pectus and metanotum fuscous black. The abdomen of the male is black, but the first two segments, the tip of the third and fifth, and the fourth and sixth except the base, are white. All the femora in both sexes excepting the white bases are black or pitchy; the fore tibiae of the female are of the same color, those of the male are white with black tips; the middle tibiae of the female are usually black, rarely with a fuscous ring; those of the male are white with black tip and base; the hind tibiae except base and tip are white in both sexes; the fore tarsi are black, the first joint is white except the tip, in both sexes; in the male the base of the second is often lutescent; the first two joints of the middle and hind tarsi of both sexes are white, with black tips, the remaining joints being wholly black; all the fourth tarsal joints short, obcordate. The wings are bare, subhyaline, with a small black spot covering the crossveins and anastomosing with a minute spot on the cubitus. Cuba. (Loew.) Fork of cubitus sessile. (S. Henshaw, in litt.) May possibly belong to Anatopynia.

8. Procladius tricolor Loew

1861 Tanypus Lw. Berl. Ent. Zeit. 309

Female. Yellowish, the thorax with reddish ferruginous stripes, fuscous marginate, the abdominal segments with black bases and yellow posterior margins; the legs black-ringed; the wings hya-

line, bare, the longitudinal veins pale, the crossveins fuscous black and fuscous bordered. Length 3.5 mm. Wing 3.75 mm.

The head is very pale yellow. The palpi fuscous. The antennae are short, fuscous, with the scapus (basal joints) pale yellow. The humeral spots of the thorax and the pleura are pale yellow; the dorsal stripes are confluent, reddish ferruginous, and fuscous marginate. The scutellum is fuscous, with a yellow median line. The metanotum is fuscous black; the pectus ferruginous. The first segment of the abdomen is wholly yellow, the second is yellow with a fuscous base; the remaining segments are black, each with a yellow posterior margin. The legs are yellow, black annulate; the median ring of the femur is wide but somewhat faint, the apical ring narrower and distinct; the tibial rings are distinct, the sub-basal one wide, the apical one narrow. The fore tarsus from the tip of the first joint is black, the middle and hind tarsi each have the tip of the first joint and all the following joints black. Halteres pale yellow. Wings hyaline, bare, the longitudinal veins are yellowish, the crossveins are fuscous black with a fuscous border. New York. (Loew.) Fork of cubitus sessile. (S. Henshaw, in litt.) May possibly belong to Anatopynia.

9. Procladius caliginosus new species

(Pl.27, fig.2)

Female. Dark brown, somewhat shining, with robust body. Wings bare, slightly smoky, crossvein clouded. Length 3.5 to 4 mm.

Resembles P. p i n g u i s Loew, differs from it in having the antennae wholly fuscous, and in having the tibiae nearly wholly brown. The head, mouth parts and antennae wholly fuscous, vertex, shining. Dorsum of thorax shining brown, with three shining dark brown stripes, the middle one divided. Scutellum and metanotum shining dark brown. Pleura pale brown, sternum darker brown. Abdomen wholly dark brown, subshining. Coxae pale, trocanters and femora yellow, the apical one third of the first pair of the femora and the apical one fourth or one fifth of the second and the third pairs brown; tibiae brown, the middle section of the middle pair slightly paler, the hind pair with a broad yellowish band beyond the middle. Tarsi brown, the basal two thirds of middle and hind metatarsi yellowish. Fourth tarsal joints obcordate. Wings slightly smoky, particularly along the course of the veins; anterior veins brown, crossvein clouded with brown. R_2 present, crossvein like, near the tip of R_1. The cubitus forks a little beyond the M-Cu crossvein. Halteres sordidly yellow. Fore metatarsus about 0.6 as long as its tibia. Several specimens, Ithaca, N. Y.

10. Procladius flavicinctus Loew

1861 Tanypus Lw. Berl. Ent. Zeit. p.309

Male. Pitchy black, shining; the base of each segment of the abdomen yellow; the wings hyaline, bare, the heavier veins fuscous; halteres white; legs yellow, the tips of the fore and hind tibiae and the apical half of all the tarsi black. Length 3 mm. Wing 2.7 mm.

Shining pitchy black. Palpi yellow; face yellow; antennae dark fuscous, its hairs of the same color. Pleura ferruginous. The base of each of the abdominal segments is yellow, the yellow of the anterior ones wide and entire, that of the posterior ones narrow and interrupted. The claspers are obtuse, equalling the seventh segment in length. The legs are yellow, the tips of the fore tibiae widely, the hind tibiae narrowly, black-ringed, the fore tarsi from the tip of the first joint, the middle and hind tarsi from the tip of the second joint onwards are black. The wings are bare, hyaline, very faintly cinereous, the more delicate veins testaceous, the heavier ones fuscous. Pennsylvania. (Loew.) Fork of cubitus petiolate. (S. Henshaw, in litt.)

11. Procladius adumbratus n. sp.

(Pl.20, figs. 1–5)

The larvae were collected in July and October in Eddy Pond, Ithaca N. Y. The larva is a buff yellow, mottled more or less with brownish spots. Length about 5 mm.

Head short, about one and one-half times as long as wide, brownish, antenna about one-fourth longer than the mandible, its basal joint more than three-fourths the entire length. The eye spots black, simple. Mandible rather slender, apical tooth sharp, black tipped; the lateral teeth small and indistinct. Maxilla large, with a prominent stout palpus. Hypopharynx composed of a pair of curved pectinate chitinous branches apparently connected in the center by membrane (fig.1, h). Labium (l) with five teeth, the laterals a little longer than the median. The lateral margins of the abdomen fringed with long but very delicate pale hairs. Anterior legs with numerous, short, curved, but not pectinate claws. The posterior claws are of two kinds, the centrals long and slender (fig.2), and the marginals short and flattened (fig.3); all of the same brownish color. The dorso-anal papillae are long and slender, each with ten long brownish setae. The four anal blood gills are pointed and slender, but not as long as the anal prolegs.

The pupa is brownish; length about 3 mm. Respiratory trumpets slender (fig.5), about as long as one of the abdominal

segments, the surface with minute, pointed, chitinous scale-like projections. Body smooth and hairless; the abdominal segments under the highest magnification minutely punctate; the lateral margins of the last two segments with four or five pale, slender filaments. The caudal fin (fig.4) with rounded paddle, and with small, short, marginal setae.

The imago, female. Head, including front, vertex, back of head, orbit, and basal antennal joint, yellowish. The second antennal joint and a triangular spot on vertex polished black; the remaining antennal joints, the dorsal surface of proboscis and palpi deep fuscous. Thorax, including pleura and pectus, yellowish like the head, the last sometimes blackish; the dorsum with three dark brown or black longitudinal stripes, the middle one divided; scutellum and metanotum blackish. Abdomen fuscous, each segment with a wide dusky yellow, posterior margin; venter dusky yellow, the hair of scutellum and the first abdominal segment stiff and black, the remaining abdominal segments with yellowish hairs. Legs yellowish, the tips of the tibiae and of the metatarsi, and the whole of the remaining tarsal joints subfuscous or blackish. Fore metatarsus about two thirds as long as its tibia. Fourth tarsal joint obcordate.

Wings subhyaline, hairless, the radial veins yellow, the basal part of the media and cubitus as far as the crossveins dusky, the latter also darkened; the other veins pale; R_2 present, near the apex of R_1; the cubitus forks far distad of the crossveins. Halteres pale yellow. Length $2\frac{1}{2}$ mm. Ithaca N. Y.

12. Procladius pinguis Loew

1861 Tanypus Lw. Berl. Ent. Zeit. p.308

(Pl.27, fig.3; pl.19, figs. 3 and 4)

The larva is of a reddish color of almost as deep a shade as a Chironomus larva. The single larval skin was lost. The pupa is fuscous; its respiratory trumpets are white, comparatively large, with the free end open and larger in diameter than at any other point. The surface quite smooth. The abdomen is nearly devoid of setae, excepting the margin of the last two segments, which are as shown in fig.4, pl.19; each with about five filaments on each side. The caudal fin is nearly circular in outline with a V-shaped notch at the apex, margin ciliate.

The imago, female. Black, shining; wings cinereous hyaline, bare, the heavier veins dark fuscous; halteres white; first pair of legs pitchy black, bases of femora yellow; middle and hind legs

yellow, the extreme tips of the tibiae and the apical half of each tarsus black. Length 3.3 mm. Wing, 3.1 mm.

The species resembles T. nervosus (European), but the yellow base of the antennae and the white halteres distinguish it with certainty. Shining pitchy black, palpi fuscous; face and front sordidly ferruginous; antennae fuscous, the scapus and the basal joints of the flagellum yellow. Pleura ferruginous; pectus yellow. The fore legs pitchy black, the coxae and basal third of each femur yellow; the middle legs yellow, the bases of their tibiae infuscated, the tips of the tibiae and the part of the tarsus from the tip of the metatarsus fuscous black; the hind legs yellow, the tip of tibia and the part of tarsus beyond the tip of the second joint fuscous black. Halteres yellowish white. Wings cinereous hyaline, bare, the more delicate veins pale fuscous, the heavier ones dark fuscous. New York.

To the above description may be added that in a newly emerged specimen the dorsum of the thorax is distinctly striped, with the space between the stripes yellowish. The fourth tarsal joint is longer than the fifth, and but little broadened. Legs sparsely haired. Fore tibia about twice as long as its metatarsus. Wing venation as figured. One bred specimen. Ithaca, N. Y.

13. Procladius scapularis Loew

1866 Tanypus Lw. Berl. Ent. Zeit. p.2
(Pl.27, fig.4)

Male. The abdomen white and black annulate, the fore tibiae and the fore metatarsi white excepting their tips.

Female. Abdomen wholly black, the fore legs excepting the bases of the femora black. Length 3 to 3.7 mm. Wings, 2.5 to 2.7 mm.

Male and female. Black, the humeri and the upper half of the pleura white, the legs white and black variegated, the wings bare, with a central black spot covering the crossveins, the fourth tarsal joint short, obcordate.

Head white, the disk of the occiput pitchy black; antennae of the female short, fuscous; of the male antennae the first joint is black, the flagellum subfuscous. The thorax of the male is black and opaque, that of the female is pitchy black and subshiny; the humeri, the collar, and the upper half of the pleura white in both sexes. Scutellum same color as the thorax. Abdomen of the male black, excepting the whole of the first two segments, the posterior margin of the third, the posterior four-fifths of the fourth, and the posterior one-half of the sixth, which are

white; the abdomen of the female is wholly black. All the femora excepting their white bases are black, or pitchy black in both sexes; the tibiae and fore tarsi of the female are the same color; those of the male are white, but the tips of the tibiae and the tarsi from the end of the first joint are black. The middle and hind tibiae are white, the base and tip widely black; the middle and hind tarsi black, the first joint except its tip white; all the fourth tarsal joints of both sexes short, obcordate. Halteres whitish. Wings bare, subhyaline, with a small black spot, which covers the crossvein and anastomoses with a small spot (also black) on the cubitus. The female differs in having black middle tibiae each with a white ring. Washington, D. C.

A male and a female specimen, the first from New Jersey, the second from Washington, D. C., in my possession agree perfectly with the above description. It may be added that the basal two-thirds of the antennae and its hairs are pale fuscous, the apical one-third darker.

Genus 16. **Anatopynia**, new genus

Tanypus Meigen. Illiger's Mag. 1803 (pt.)

Belongs to the group Tanypus. Antennae fifteen-jointed in both sexes; wings bare; R_2 usually present near the tip of R_3; fork of the cubitus slightly proximad of the M-Cu. crossvein. Type of the genus T. plumipes Fries (1823).

To this genus probably belong also the following European species: forcipatus Egger (1863); nudipes Zett. (1850); consobrinus Zett.; lactipennis Zett.; morio Zett.; pubitarsis Zett. The species tricolor Lw. (N. Y.), humeralis Lw. (Cuba) and turpis Zett. (Greenland) may possibly belong in this genus. See descriptions on p. 127, 130. Of this group Meinert (1886) has figured the respiratory organ of the pupa of plumipes.

Genus 17. **Ablabesmyia**, new genus

Tanypus Meigen. 1803 (pt.); Tanypus Skuse. 1889

Antennae 15-jointed (counting basal joint); wings hairy, the cubitus forks at or before the M-Cu. crossvein.

For this subdivision Skuse (1889) had proposed to retain the name Tanypus Meigen, but this cannot be maintained for the reasons given on p.125.

KEY TO SPECIES OF ABLABESMYIA

Larvae

a Labium with but four teeth, pl.19, fig.5...25. Species from Ithaca, N. Y.
aa Labium with five teeth
b Several claws of the posterior feet stouter and conspicuously darker colored than the others, pl.19, fig.14. Antennae over three times as long as the mandibles.....6. monilis
bb Claws of posterior feet all the same color
c Antennae rather short and stout (pl.20, fig.1) less than 1.5 times as long as the mandible; sides of abdomen fringed laterally with hairs.....Procladius adumbratus (q. v.)
cc Antennae over twice as long as the mandibles
d Teeth of labium of about equal length; antennae three times as long as the mandible, pl.20, fig.6.....4. carnea
dd Not as above
e Mandible stout at base with distinct tooth near apex; basal joint of antenna about two thirds of total length, pl.19, figs. 16 and 17.....22. fastuosa n. sp.
ee Antenna with its basal joint over three fourths the total length, pl.19, fig.1.....16. flavifrons n. sp.

Pupae

a Swimming paddle rounded, not sharply notched at apex
b Trumpet rather elongate, over four times as long as wide; swimming paddle as shown in pl.20, fig.4
Procladius adumbratus (q. v.)
bb Trumpet short (pl.19, fig.3); swimming paddle as shown on pl.19, fig.4.....Procladius pinguis (q. v.)
aa Swimming paddle with two pointed lobes
b Thoracic respiratory organ (trumpet) egg-shaped, with very small aperture, pl.19, fig.13.....6. monilis
bb Breathing organ funnel or club-shaped
c Breathing organ club-shaped, pl.19, fig.2..16. flavifrons n. sp.
cc Breathing organ not of this type
d Swimming paddle rather broad, but little longer than wide, pl.19, fig.6. Trumpet as shown in fig.7.....10. dyari
dd Swimming paddles quite pointed
e Paddle and breathing trumpet as shown on pl.19, figs. 18 and 19.....22. fastuosa
ee As shown on pl.20, figs. 7 and 8.....4. carnea

Imagines

a Wings clouded (banded or spotted)
b Legs nearly uniform in color
c Wings uniformly spotted with fuscous; fuscous species; the thorax with three dusky stripes; legs yellow; length 4.5 mm.; female. (= ?decedens Walk.).....1. pictipennis
cc Smaller paler species; the wings with few large bars or spots
d The first fascia of the wing lies distad of the crossvein; length 2½ to 4 mm.....2. bifasciata

dd The fascia lies proximad or over the crossvein

c The abdominal segments of the male each have brown posterior margins; head brown, 3 mm. ..... 3. futilis

cc The abdominal segments of the male have brownish fasciae or spots near *anterior* margin of each; the female has a brownish abdomen with paler posterior margins to the segments

f Three to five mm. in length; pale yellowish; abdominal fasciae of the male pale brown; dorsal stripes reddish or brown ..... 4. carnea

ff Two and one half mm. or less in length; thorax brownish; dividing lines cinerous ..... 4a. var. a. carnea

bb Legs distinctly bicolored

c Wings spotted but not banded

d Species with brown or black thorax and abdomen, pl.37, fig.17 (Greenland) ..... 5. pulchripennis

dd Pale (reddish or yellowish) species

e Tibia with three rings; femur with one at the tip (=annulatus Say) ..... 6. monilis

cc Tibia not with three rings

f Femur with two brownish rings near the apex; wing with about eleven brown spots (California and New Mexico) 7. venusta

ff Femur with one ring

g Abdomen of male pale yellow, black and brown fasciate; wing with apex from slightly before tip of R_1, grayish brown and containing several whitish hyaline drops; length 5 mm. (Washington) ..... 8. guttularis

gg Abdomen brownish fasciate; wing with apical half with many mostly isolated brown spots; length 3 to 4 mm. (New Mexico) ..... 9. barberi

cc Wing with one or more cross bands

d Femora and sometimes tibiae also with brown bands

e Wing with median band and apical third of wing brownish, marked with several hyaline spots; each femur with subapical ring, tibia with basal ring; length 3 to 4 mm. 10. dyari

ee Apex of wing with band or spot, but no hyaline spots in it

f Wings yellow, humeral crossvein brown clouded, brown fascia across wing and at apex of vein R_1, each femur with apical and tibia with basal band; tarsi white, apical joint brown; length 3 to 3.5 mm. (New Jersey) .. 11. johnsoni

ff A pale brown cloud near the tip of the wing also; length 3 to 5 mm. ..... 12. ornata

dd Femora and tibiae not banded, or with only apices of femora and either bases or apices of tibiae slightly darkened

e Wing with one faint brown band. Yellow species with three thoracic stripes, metanotum, spots on pleura and sternum, brownish black; apices of femora and bases of tibiae brownish; length 3 mm.; female (Alaska) ..... 13. algens

cc Wing with two cross bands and the apex largely brown, these bands containing hyaline spots; apices of femora and tibiae slightly darkened; length 3 mm. (New Hampshire) (compare d y a r i).....14. d i s c o l o r

aa Wings not clouded excepting sometimes the crossvein or a faint smokiness near the apical end

b Pale species

c Species over 3 mm. in length

d Wholly yellowish species.....15. m e l a n o p s

dd Abdomen, at least of the male, with brown fasciae

e Thoracic stripes, metanotum, and sternum brown 16. f l a v i f r o n s n. sp.

ee Thoracic stripes, etc., yellow.....24. n i g r o p u n c t a t a

cc Species less than 2.5 mm. in length

d Thorax not striped; pale yellow species

e Length 1.5 to 2 mm., front metatarsus nearly as long as its tibia; (St Vincent Island).....17. f l a v e o l a

ee Length 1 mm., basal cells of wing short (D. C.) 20. p i l o s e l l a

dd Thorax with longitudinal stripes

e Abdomen pale yellow; the male with segments two to five with a band near the base and nearly the whole of the following segments pale brownish; mouth parts brown; R_2 present near the tip of R_1; length 1.25 to 2.5 mm. (New Mexico). (A variety with yellow mouth parts from New York.) 18. p a l l e n s

ee Not as above; basal cells of wing short

f Species 1.5 to 2.25 mm. long; abdomen brown with ashy posterior margins to the segments; crossvein proximad of the basal third of the wing (New York and St Vincent Island) 19. i n d e c i s a

ff Species 1 mm. in length (Washington, D. C.) 20. p i l o s e l l a

bb Darker species

c Halteres pale fuscous; blackish; legs sordidly yellowish brown; tibiae long-haired; thorax dark; abdomen somewhat shining and fuscous haired; the R–M crossvein near the middle of the wing; length 2.5 mm. (Greenland).....21. t i b i a l i s Staeger

cc Not as above

d Length 3 mm.; metatarsus about 0.6 as long as the tibia; halteres white .....22. f a s t u o s a n. sp.

dd Length 3.5 to 4 mm.; halteres luteous.....23. h i r t i p e n n i s

1. Ablabesmyia pictipennis Zetterstedt

1838 T a n y p u s Zett. Ins. Lappon. 818. (=? T. d e c e d e n s Walker)

1878 T a n y p u s O. S. Cat'l. Dipt. 22

Female. Fuscous black, pilose; the thorax with three dusky stripes; the wings white, uniformly sprinkled with fuscous clouds; the halteres white; the legs yellow. Length 4.5 mm. This species

resembles T. nebulosus (an European species) but is a little smaller, the abdomen is not annulate, the incisures only being narrowly pallid, and the wings are white, uniformly fuscous spotted, hairy. Greenland. (Staeger and Lundbeck.)

T. nebulosus mentioned above is a grayish brown fly about 7 mm. long, with striped thorax and banded abdomen; legs reddish yellow, the tibiae with dark tips and the tarsi dusky; wings hairy, clouded; the fork of the cubitus sessile.

The description of Tanypus decedens Walker p.22. (1848) is as follows: This species resembles T. nebulosus Meigen, but the spots of the wings are much fainter and the tips of the thighs and of the shanks are not dark. Length of the body, 4 mm. Of the wings 10 mm. St. Martin's Falls, Albany River, Hudson Bay Ter.

2. Ablabesmyia bifasciata Coquillett

1901 Tanypus Coq. Proc. U. S. Nat. Mus. 23:609

Male. Differs from johnsoni (see number 11) as follows: Front corners of scutellum brown, apical joint of tarsi white, no brown band on femora, nor on tibiae, brown of abdomen confined to a fascia at base of segments 2 to 6 and middle of dorsum of seventh, (front tarsi wanting), hairs of wings chiefly brown, humeral crossvein not bordered with brown, the first fascia lies beyond the small crossvein; length, 4 mm.

Female. Hairs of antennae whitish, abdomen yellow, destitute of brown markings, otherwise as in the male. Length 2.5 mm. A specimen of each sex.

Habitat. Riverton, N. J. (C. W. Johnson)*; Pennsylvania; and Boston, Mass.

3. Ablabesmyia futilis Van der Wulp

1868 Tanypus Wulp. Tijd. v. Ent. ser.2. 2 (X), 130

Fuscous; the abdomen white and fuscous annulate; scutellum, legs and halteres pale yellow; wings pilose, clouded and spotted; fork of the cubitus sessile. Male; length, 3mm.

Male. The head is dark brown, on the eye margins with a paler sheen; proboscis and palpi brown; antennae with its hairs yellowish brown. The thorax moderately arched, dark brown, the anterior margin, the humeri, and a pair of longitudinal stripes upon the dorsum with a whitish sheen; scutellum whitish yellow; metanotum blackish. Abdomen transparent whitish, with a broad brown posterior margin on each segment and a blackish brown interrupted longitudinal dorsal stripe; the last segment wholly darkened, somewhat flattened, the last two segments a little broad-

ened; the claspers brownish yellow, as long as the last segment; the hair of the abdomen pale yellow or light brown, very dense and long. Legs unicolored, pale brownish yellow; the coxae alone somewhat darker; the fore tarsi not hairy; the fore metatarsus about one fourth shorter than the tibia; the fore femora upon the flexor surface, as also the whole of the hind legs with a moderately long, delicate, yellowish hair. Halteres pale yellow or whitish. Wings hairy, hence grayish, clouded and spotted; the most conspicuous spot covers the crossveins, another spot nearer the wing tip between the radius and media, another below the crossvein not far from the posterior margin; the humeral crossvein is black; the media is bent downwards a little just before its ending at the wing tip; the fork of the cubitus begins at the M-Cu crossvein and is therefore sessile. Translation from the Dutch of V. d. Wulp. Wisconsin.

4. Ablabesmyia carnea Fabricius

1805 Chironomus Fabr. Syst. Ant. 41, 16
1818 Tanypus Meigen. Syst. Beschr. 1:67, 21
1850 Tanypus Zetterstedt. Dipt. Scand. 9:3620
1864 Tanypus Schiner. Fauna Austriaca. 2:620
1877 Tanypus V. d. Wulp. Dipt. Neerlandica. p.304
1823 Tanypus albipes Fries. Monogr. Tanyp. Suec. 16, 11

(Pl.20, figs. 6, 7, 8)

Larva. Larvae from Ithaca, N. Y. Reddish yellow. Head about three times as long as wide, the antennae slender, three times as long as the mandible, the first joint three-fourths of the total length. The labrum smooth above, hairy beneath, with two short and two more elongate, very slender-jointed papillae. Mandibles slender, apical tooth black tipped, elongate, lateral teeth small and irregular. Maxilla with a stout cylindrical palpus, having a crown of 5 or 6 apparently jointed terminal joints. The marginal teeth of the labium are rounded, of equal size and five in number; those of the hypopharynx are minute, rounded and also of equal size (fig.6, h). The body has a very few scattered minute setae. Caudal appendages as shown in pl.19, fig.10. The claws of the posterior legs are very slender, and the slender, central ones apparently without a basal prominence. Anterior claws quite numerous and slender, not pectinate.

Pupa. Yellowish; length 4 mm. Respiratory trumpet cucumber shaped with basal end somewhat curved and tapering (pl.20, fig.7); near the base of each is an arcuate transverse line of short, pale, blunt tubercles. Abdominal segments nearly devoid of setae. The caudal fin (pl.20, fig.8) consists of two pointed

processes, each with a pair of pale, slender filaments, and on the lateral margin of each of the last two segments are four or five of such filaments.

Imago. Male and female. Pale yellow, wings marked, legs pale yellow. Length 3 to 5 mm.

Male. Head pale yellow, including basal joint of the antenna. Antennae yellowish brown, eyes black, palpi and apex of the proboscis fuscous. Thorax pale yellow with three wide buff-colored stripes; or it may be said that the dorsum of the thorax is buff-colored, having three fine whitish lines, upon each of which there is a close row of pale hairs. In some lights the anterior part of the thorax, a space in front of the scutellum and the scutellum have a whitish sheen. Pleura, metanotum and sternum are yellow or buff-colored, the first has 3 brownish bars or spots; the last has its sides brownish. The abdomen is pale yellow; near the anterior margin of each segment is a transverse row of brown spots; these are sometimes confluent and thus form bands; the last two or three segments are more brownish. Genitalia conspicuous, pale yellow. The hairs on abdomen and genitalia pale. Legs, including coxae, cream-white, the hairs pale, apex of each tibia with a very minute black comb with one tooth prolonged into a spur. Fore metatarsus more than three-fourths as long as its tibia. Wings hairy; a brown cloud covering the crossveins, a larger paler cloud at the tip of R_1 extending nearly across the wing, but very faintly beyond the media; a third faint cloud at the apex of Cu_2 extending to the media; a fourth very faint one in the anal cell. Veins pale, except the crossveins which appear dark. Some of the spots on the wing in some specimens coalesce so their wings may be said to have two cross bands. Halteres white.

Female. Differs from the male in having pale yellow antennae; palpi sometimes pale, abdomen yellow, the posterior margin of the segments with a whitish sheen. The wings are broader.

Var. a. female. Differs from the above in having the anterior end of all three dorsal stripes tipped with dark brown, and two small dark brown spots on the middle of the median stripe. Metanotum with a white central line, pleura with three brown dashes, two vertical and one horizontal. Several specimens. Ithaca N. Y.

Var. b. female. Differs from a typical specimen in having a deeper yellow thorax, brownish stripes, yellowish brown metathorax, pleura and sternum yellowish brown or brownish. Abdominal segments with indistinct yellowish posterior margins. Legs yellow, last two tarsal joints infuscated. Several specimens. Ithaca N. Y.

Var. c. male. Yellowish brown; length 2 to 2.5 mm. Thorax, including pleura, sternum, and metanotum reddish brown, scutellum and humeri yellow, dorsum of thorax with three indistinct longitudinal stripes darker brown. By oblique light it appears as if there were four dark brown stripes and five narrow whitish ones. Abdomen yellowish white, with the anterior margin of each segment blackish, this color produced backward on the dorsal and ventral surface in a fine line, forming broken longitudinal stripes. Posterior segments and the genitalia more brownish.

Female like the male, but the abdomen is brown, with slightly paler posterior margins. Ithaca N. Y.

5. Ablabesmyia pulcripennis Lundbeck

1898 Tanypus Lundb. Vidensk. Meddel. p.293

(Pl.37, fig.17)

Male. Thorax cinereous black, with three wide black stripes, the median one posteriorly, the two lateral ones anteriorly abbreviated, the former divided by a fine longitudinal line, the intermediate space and the lateral margin of the dorsum with erect black pile; scutellum and metathorax black, the sternum and the sides of the thorax cinereous. Abdomen slender, black, with dense brown pile, the claspers quite large, shining, pilose. Antennae brownish. Legs brown or dusky, tibiae and tarsi white annulate. Halteres yellow. Wings densely clothed with hairs, and therefore cloudy; at the costal margin yellowish tinged, the costal veins pale brown, the others not colored. The venation as shown on pl.37, fig.17. The legs have long pile, the fore metatarsus is one-third shorter than the tibia.

Female. The female is shorter and stouter than the male, the legs are a little paler, the femora yellow, with the tips blackish brown. Legs all with shorter and less dense pile, the antennae brown, shorter than the thorax, in other respects like the male. Greenland. Translation.

6. Ablabesmyia monilis Linne

1758 Tipula Linn. Syst. Nat. ed. X. p.587
1767 Tipula Linn. Syst. Nat. ed. XII. 2:975
1804 Chironomus Meigen. Klass. 1:19, 24
1818 Tanypus Meigen. Syst. Beschr. 1:60
1850 Tanypus Meig. Zett. Dipt. Scand. 9:3613
1864 Tanypus Meig. Schiner. Fauna Austr. 2:620
1877 Tanypus Meig. Wulp. Dipt. Neerl. 1:302
1776 Tipula maculatus Degeer. Mem. l'hist. Ins. 6:394
1823 Tanypus annulatus Say. Jour. Acad. Nat. Sc. Phil. 3:15

(Pl.19, figs. 11, 12, 13, 14, 15, and pl.27, fig.6)

Larva. The larvae were found in Ithaca and Saranac Inn, N. Y. They are yellow with brown markings; length 6-7 mm. Head brown, about twice as long as wide; antennae slender, 2.5 times as long as the mandibles, the basal joint about six-sevenths of the whole length. Mandible slender (fig.14 md) the apex black and sharp, the two lateral teeth short and sharp. Maxilla (mx) large with a mesad projecting process; its palpus (p) jointed, about one-half as long as the mandible, with a pair of apical papillae. Labium (l) with five black teeth, the laterals larger and longer than the median; hypopharynx (h) with a toothed margin, excepting its middle section (covered by the labium) which connects the lateral parts. The anterior claws are numerous, slender, curved at the tip but not pectinate. The abdomen is glabrous. The posterior appendages resemble those shown in fig.10, having elongate dorsal papillae each with about six apical setae. The claws of the anal prolegs differ from those of allied species in having two on each foot stouter, and much darker colored (fig.12) than the others (fig.11). Besides the stout dark ones there are the usual number of paler, stout marginals, and slender centrals.

Pupa. Dark yellow, mottled; length 3.5 to 4 mm. Respiratory organs ellipsoidal, dark colored (fig.13), smooth surfaced, the polygonal areas of the chitin distinctly visible. The apical aperture minute. At the base upon the thorax there is a transverse row of small, sharp tubercles. The surface of the abdomen without hairs, excepting the lateral margin of the last two segments, which have four or five long filaments. The caudal fin has two pointed lobes each with a pair of filaments.

Imago. Whitish; antennae of the male with pale brown hairs; of the female still paler; palpi yellowish. Thorax pale ashgray with five narrow longitudinal stripes, with wider intermediate spaces; the fine lines with hairs; scutellum reddish yellow, metanotum brownish black. Abdomen of the male with a more or less distinct interrupted longitudinal stripe, which broadens on the last segments; the claspers whitish, rather short (pl.32, fig.3). In the female the abdomen is wholly dark brown. Legs white, with narrow brown rings, one just before the tip of the femur, three on the tibia, two on the first tarsal joint and one on each of the following joints. In the male the fore tarsi and the hind legs are short haired; the fore metatarsus about one-fourth shorter than the tibia. Halteres white; wings with a whitish tint, hairy, with brown bordered crossveins and many brownish gray spots. R_2 is present, near the tip of R_1; the cubitus forking proximad of the crossvein. Length 3.5 to 4.5 mm.

I can not distinguish the American specimens from those which I have from Europe. The marks upon the abdomen of the male are quite variable; in some specimens they are simply spots on the posterior lateral margins of the segments, in others they form a broken median dorsal stripe, and in still others they are almost entirely wanting. The male genitalia in some specimens are somewhat brownish. The dark spots upon the wing are arranged as follows: One on the humeral crossvein, one on the discal crossveins, one at the tip of R_1, and one at the tip of R_{4+5}. The paler spots are larger than the darker ones. There is one below the tip of R_{4+5}, one in the middle of cell R_{4+5}, a small one at the tip of the median, and one at the tip of each branch of the cubitus, one or two in the median cell and several in the anal cell. The fork of the cubitus is also clouded. Some of these spots are not always distinct because the color is due to the darker colored hairs, which are easily rubbed off. The wing of the female is usually darker than that of the male. (Pl.27, fig.6.) Specimens from New Jersey, Illinois, Ithaca, N. Y., South Dakota.

Osten Sacken, in a note in his catalogue of the North American Diptera (1878), first calls attention to the fact that T. annulatus Say and monolis Linn. may be synonymous. I have compared the North American species, which agree perfectly with Say's description, with specimens of monilis from Europe, and I can find no differences. For the sake of comparison, Say's description is given below.

Tanypus annulatus Say

Jour. Ac. Nat. Sc. Phil. 3:15. 1823

Tergum annulate with dusky; wings clouded with dusky and with three or four blackish points. Inhabits Pennsylvania.

Head and stethidium red-brown; thorax, the anterior dilated line with a brown line along its middle; feet white, thighs having an annulus near the tip, and tibia with one at base and two near the tip fuscous: wings with large, obsolete, dusky, spots or clouds, and three or four black-brown points, of which two are toward the middle of the wing, and the remainder on the costal margin near the tip; tergum segments with a dusky annulus at their bases. Length about 3/20 in. Male.

7. Ablabesmyia venusta Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:91

(Pl.27, fig.8)

Male. Head black, mouth parts brown, antennae pale yellow, middle of joints of basal half and whole of the apical joint brown, the hairs brown and yellowish; thorax black, opaque, mottled with grayish pruinose spots and lines; scutellum yellowish, its narrow base, stripe in middle, and nearly whole of under side dark brown; abdomen whitish, an interrupted band on the hind end of the first five segments and nearly the whole of the following segments brown; legs yellow, two bands near apex of each femur, one near base of each tibia, also apices of tibiae and of joints of tarsi brown; wings covered with hairs, hyaline, marked with about 11 brown spots located at extreme base of wing, on humeral crossvein, before middle of axillary cell, beyond middle of anal cell, on the central crossveins, near middle of cell R_{4+5} near apex of this cell, beyond middle of cell M and of cell Cu, and at the apices of the vein R_1 and of R_3; R_1 near its apex connected with R_3 by R_2; cubitus forks slightly before the crossvein. Length 4 mm. Los Vegas Hot Springs, N. M.

Four male specimens from Leland Stanford jr. University, California, agree with the description given by Mr. Coquillett, excepting that the fasciae at the posterior margins of the abdominal segments are not interrupted, but are produced forward a little at the middle. Upon the ventral surface of each segment in front of the posterior margin there is a black spot. The large basal joint of the antenna and the genitalia are brown. Halteres yellow.

Four female specimens from the same place are like the male, but the antennae are wholly fuscous, and the abdomen is darker, with more yellowish, and the venter is brown. The fore metatarsus is about six tenths as long as its tibia.

8. Ablabesmyia guttularis Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:92

Head and its members dark brown, joints two to four of antennae, apices of the other short ones, and a space before the apex, light yellow, plumosity brown, changing into whitish at the apices; thorax black, opaque, gray pruinose, mesonotum marked with three indistinct dark vittae, the middle one divided by a median black line prolonged to the scutellum, the latter light yellow; the abdomen pale yellowish, first segment with two brown vittae, the others with a black fascia before the middle of each, hairs of

each segment consisting of an anterior whorl and a posterior transverse pair of clusters; legs light yellow, coxae black, a brown band before apex of each femur and another beyond base of each tibia, apices of tibiae and of tarsi brown, front tarsi ciliate with several rather long hairs; wings wholly covered with hairs, whitish hyaline, from base to small crossvein marked with four brown spots, one on humeral crossvein, two in anal cell, and one before apex of basal cell R, passing over the crossvein at apex of basal cell M and reaching the wing margin, where it is greatly extended and rather faint; a brown spot at base of vein R_{4+5}, apex of wing from slightly before the tip of R_1 grayish brown and containing several whitish hyaline drops; R_1 near its tip connected with R_3 by the oblique R_2; halteres whitish; length 5 mm. Two males. Pullman, Washington.

To the above description I may add that the female differs from the male in having the abdominal segments more yellowish, with narrow basal fasciae, and the wing markings are somewhat darker, the anal cell being brown with several hyaline spots; length 4 mm. Five females. Pullman, Washington.

9. Ablabesmyia barberi Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:90

Male. Yellowish white, apices and a broad band at middle of antennae; three vittae on mesonotum; the metanotum, spots on the pleura and sternum, black; mouth parts, a band near bases of segments 2 to 5; the whole of the following segments except their hind borders, also apices of femora, both ends of tibiae, apices of first four joints of tarsi and whole of last one, pale brownish; mesonotum opaque, gray pruinose; hairs of the antennae pale yellowish; wings covered with hairs, hyaline, from the base to the small crossvein marked with three brown spots, one on the humeral crossvein and two behind the anal vein; from small crossvein to wing tip are many, mostly isolated, brown spots; R_1 near its apex connected with R_3 by the oblique R_2; cubitus forks slightly before the crossvein; length 4 mm.

Female. Like the male except that there is no black ring at middle of the antennae, and the abdomen is dark brown, changing into yellow at the apex, the broad hind margins of the segments whitish; length 3 mm. Las Vegas, Hot Springs N. M.

10. Ablabesmyia dyari Coquillett

1902 Tanypus Coq. Ent. News. p.85

(Pl.19, fig.7, and pl.27, fig.9)

The pupa is figured and briefly described by Doctor H. G. Dyar (1902) p.56. He says, "It resembles a Culex pupa,

has the same habits, resting at the surface of the water with the slender funnel-shaped prothoracic air tubes penetrating the surface film and quickly descends when disturbed. The anal paddles resemble those of Culex, but are more hairy."

This species was also bred in a laboratory jar at Ithaca N. Y., the larva having been collected from one of the ponds in the vicinity. The empty larval skin of the single specimen was lost.

Pupa. Fuscous green. Respiratory trumpet (pl.19, fig.7) somewhat elongate, its free end open, the surface rugose. There are no blunt setae near the base. Body nearly devoid of setae, excepting the margin of the last two segments, which have four or five lateral filaments each. The caudal fin consists of two pointed lobes with ciliate margins (pl.19, fig.6).

Imago. Male and female. Yellowish brown, the scutellum, abdomen, halteres and legs pale yellowish, the abdomen changing into yellowish brown toward the apex and with a similarly colored band on the preceding segments except the first, a brownish band before apex of each femur and near the base of each femur and near base of each tibia; antennal plumosity of male brown mixed with whitish and changing into white at the apex; mesonotum opaque, grayish pruinose, the three vittae indistinct, yellowish brown; abdominal segments 2 to 6 bearing near the base a dorsal cluster of rather long brown hairs; front tibiae only pubescent, their tarsi bearing a few rather long hairs, middle and hind tibiae densely covered with such hairs; wings densely haired, hyaline, a median band and the apical third brownish and marked with several hyaline spots; median band very irregular, greatly contracted at the middle and expanded at each end, the median crossvein about at its middle and clouded with darker brown, the hyaline spots principally situated near the hind margin of the wing; brown at apex of wing contains about eight hyaline spots and dots; cubitus forks slightly before the crossvein; length 3 to 4 mm. Washington D. C.; New York; Massachusetts; South Dakota; Pennsylvania, and Michigan.

In an immature specimen the parts of the body described above as yellowish are more or less green. Wing venation as figured on pl.27, fig.9. The fore metatarsus is but little over one-half as long as its tibia.

11. Ablabesmyia johnsoni Coquillett

1901 Tanypus Coq. Proc. U. S. Nat. Mus. 23:609

Male. Yellow, the scutellum, halteres, and tarsi white; apical joint of the latter, a band before apex of each femur and near base of each tibia brown, abdomen whitish, each segment with

an irregular brown mark, composed principally of two median vittae and a posterior arcuate fascia, most distinct on the median segments, on the apical ones expanded so as to cover nearly the entire dorsum; hairs of antennae mixed pale yellow and brown, their apices chiefly whitish, mesonotum opaque, whitish pruinose; in certain lights three dark yellow vittae are visible; front tarsi clothed with very short hairs, the first joint two-thirds as long as the tibia; wings whitish hyaline, almost wholly covered with yellow hairs, humeral crossvein bordered with brown, a broad pale brownish fascia crosses the wing just before the small crossvein, and a second slightly broader one at apex of R_1, cubitus forking a short distance before the small crossvein; length 3.5 mm.

Female. Differs from the male as follows: Abdomen with dark yellow mottlings, destitute of brown markings, hairs of antennae whitish, vittae of mesonotum more distinct; length 3 mm. Riverton N. J.

12. Ablabesmyia ornata Meigen

1838 Tanypus Meig. Syst. Beschr. 14, 7:31
1864 Tanypus Schiner. Fauna Austr. 2:620
1877 Tanypus V. d Wulp. Dipt. Neerl. p.304

Male. Pale yellow; the antenna and its hairs of the male pale brown. Thorax with three deeper yellow stripes; the two lateral ones bounded anteriorly by a fine brown or black line, which is continued over the pleura to the base of the wing; metanotum brownish. Abdomen with slightly darkened incisures; the last segments of the male brownish yellow; claspers yellowish, quite stout. Legs whitish; near the apex of the femur a brownish ring; the tips of the tibiae slightly browned; fore metatarsus a little shorter than the tibia; fore tarsi of the male slightly ciliate. Halteres white. Wings hairy, pale yellow, with two cross bands and a dark spot at the anterior margin a short distance from the tip; the crossveins blackish bordered; the venation as usual. Length 5.5 mm.

Var. a. female. Differs from the above in having the abdomen with mottled dark brown irregular fascia on each segment. The fore metatarsus about three-fourths as long as its tibia.

Var. b. female. Differs from the typical form in having three distinct, opaque, ferruginous thoracic stripes, humeri white, anterior margin of the dorsum narrowly blackened; no blackish pleural spots; metanotum and sides of scutellum ferruginous or brownish. Abdomen brown, segments with paler posterior margins. The brown clouds on the wings so coalesce that the wings may be described as having two wide, irregular cross bands, one before the middle and one between the middle and the tip; crossveins almost black. Several specimens, Ithaca, N. Y.

13. Ablabesmyia algens Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:90

Female. Yellow, three vittae on the mesonotum; the metanotum, spots on the pleura, and the sternum, brownish black; mouth parts, apices of femora, and bases of tibiae brownish; mesonotum grayish pruinose, the vittae somewhat polished; wings covered with hairs, hyaline, crossed at the middle by a faint brownish band which extends from small crossvein half way to the wing tip; R_1 near its apex connected with R_3 by the oblique R_2; cubitus forks slightly before the crossvein; length 3 mm. Popoff Island, Alaska.

14. Ablabesmyia discolor Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:89

Female. Yellowish brown; antennae, scutellum, large portion of abdomen, legs except apices of femora and tibiae, also the halteres, yellow; mesonotum grayish pruinose, most dense at the humeri and in front of scutellum; wings whitish hyaline; two crossbands and the apex largely brown; the first band is on a line with the humeral crossvein, and along costa is broadly connected with the second band, which is located at the small crossvein; behind the cubitus the second band is prolonged to meet the brown at apex of wing; the latter begins a short distance before the apices of R_1 and of Cu_2, and encloses a large hyaline spot in apex of cell M and cell Cu_1, also two yellowish costal spots; the brown along the costa comprises two spots of a darker color than the remainder of the brown at the apex of the wing, and between the first of these spots and the preceding brown band is a large yellow costal spot; wings densely covered with hairs, which are yellowish on the hyaline portions and brown on the dark spots; R_1 connected with R_3 a short distance before its tip by the oblique R_2. Cubitus forks slightly before the crossvein. Length 3 mm. New Hampshire.

15. Ablabesmyia melanops Wied. (Meig.)

1818 Tanypus Meigen. Syst. Beschr. 1:65, 18
1850 Tanypus Zett. Dipt. Scand. 9:3621
1864 Tanypus Schiner. Fauna Austr. 2:621
1877 Tanypus V. d. Wulp. Dipt. Neerl. p.306
1757 Tipula ?arundineti L. Fauna Suec. ed.II. p.434
1818 Tanypus Meig. Syst. Besch. 1:66, 19
1823 Tanypus bicolor Fries. Monogr. Tanyp. Suec. 17, 12

Pale reddish yellow, including the antennae, palpi, legs and halteres; eyes black. Thorax with three reddish longitudinal stripes, the median one divided; the intermediate spaces and the

flattened area in front of scutellum with a whitish sheen. Abdomen of the male whitish; the posterior segments sometimes with reddish longitudinal stripes. The abdomen of the female a pale flesh color. Legs almost white. Fore metatarsus about three fourths the length of its tibia; the fore tarsi of the male and the hind legs hairy. Wings whitish, unspotted, with pale hairs and almost colorless veins; R_2 short, near the tip of R_1 appearing like a crossvein, but difficult to see on account of the hairs; the cubitus forks proximad of the crossvein, the latter being proximad of the middle of the wing. Length 3.5 to 4.5 mm. Specimens from Ithaca, N. Y., Michigan, Nebraska and New Jersey. I can not distinguish the American specimens from those which I have from Europe. The dorsal stripes of the thorax are buff-colored, but they are usually distinct.

Var. b. female. Thoracic stripes reddish. Length 2.5 mm. From Ithaca, N. Y.

16. Ablabesmyia flavifrons n. sp.

Larva. The larvae were found rather abundantly in a small ditch of flowing water. Ithaca, N. Y.

Sordidly white, slightly mottled with brownish; length 9 mm. Head pale brown, about 1.5 times as long as wide; the parts of the head resemble those figured on pl.20, fig.6. The antennae are about 2.5 times as long as the mandible, the basal joint being nearly seven eighths of the whole length. The maxilla is large, the palpus prominent but shorter and stouter than that shown in the above-mentioned figure (compare figs. 1 and 14). The labrum, hypopharynx, and the feet are like those of monilis (pl.19, fig.14), but all the claws of the posterior feet are of the same color.

Pupa. The only essential difference between this pupa and that of monilis (pl.19, fig.8) is the absence of the row of tubercles at the base of the breathing trumpet and the form of the trumpet. The latter is rather small, about two thirds as long as the third abdominal segment, enlarged at the apical end (pl.19, fig.2).

Imago, male. Yellowish white and brown. Abdomen fasciate. Legs pale. Length 3.5 to 4.5 mm.

Head yellow, palpi and tip of proboscis subfuscous; basal joint of the antenna dusky, flagellum brown with brown hairs, second antennal joint yellow. Pleura, scutellum and dorsum of thorax pale yellow, the last with three broad, dull brown stripes, the middle one divided; sternum and metanotum blackish. Abdomen pale yellow, the anterior third or half of each segment brown; genitalia and venter pale yellow. Legs yellowish, tarsi some-

times slightly darker, extreme tip of each tibia with black speck; fourth tarsal joint linear; fore metatarsus about three fourths as long as its tibia; fore tarsi and middle and hind legs with rather long hairs. Wings hyaline, pale yellow haired, crossvein not clouded; R_2 present near the tip of R_1, cubitus forking slightly before the crossvein. (Pl.27, fig.11.) Halteres pale.

Female. Antennae wholly yellow, except fuscous apical joint; abdomen dusky yellow, posterior margins of segments slightly paler.

This species agrees with the description of nigropunctatus Staeger (1839), but the sternum and metanotum are dusky and not yellowish. Several bred specimens Ithaca, N. Y.; Idaho; Pullman, Washington.

17. Ablabesmyia flaveola Williston

1896 Tanypus Will. Trans. Ent. Soc. Lond. p.275

Male. Posterior forked cell not petiolate; wings hairy; front metatarsi nearly as long as their tibiae. Light yellow; antennae brownish, the plumosity gray; abdomen somewhat infuscated towards the tip; legs light yellow throughout, with rather abundant light yellow hair; wings hyaline, clothed moderately densely with gray hair. Length 1.5 to 2 mm. St Vincent Island, West Indies.

18. Ablabesmyia pallens Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:91

Male. Head brown, mouth parts and basal joint of antennae concolorous, remainder of antennae yellow, the hairs brown and whitish; thorax whitish, three vittae on mesonotum, metanotum, spots on the pleura and sternum dark yellow; abdomen pale yellow, a band near base of segments 2 to 5 and nearly the whole of the following segments, pale brownish; legs and halteres whitish; wings hyaline, covered with hairs, R_1 near its apex connected with R_2 by the oblique R_2; cubitus forks slightly before the crossvein; length 2.5 mm.

Female. Abdomen wholly yellow, otherwise as in the male; length, slightly over 1 mm. Las Vegas, Hot Springs, N. M.; New Jersey, (Johnson, '04).

Var. a, (pl.27, fig.14.)

Male. Dorsum of thorax with three wide fuscous stripes, humeri and scutellum yellow, the latter perhaps a little darker. Pleura brown, metanotum and sternum blackish. Palpi and proboscis yellow. Specimens from Ithaca, N. Y.

19. Ablabesmyia indecisa Williston

1896 Tanypus Will. Trans. Ent. Soc. Lond. p.276
(Pl.27, figs. 12 and 13)

Male and female. Wings hairy; posterior forked cell not petiolate; front metatarsi shorter than their tibiae. Head and basal joint of the antennae reddish yellow; palpi and the remainder of the antennae brownish yellow; antennal plumosity of the male gray, towards the tip blackish. Thorax reddish yellow; bare, opaque, with three slender, reddish brown stripes in front, separated by ashy intervals; on each side posteriorly with an elongate brown spot, the middle of which is ashy; scutellum light yellow; metanotum brownish red. Abdomen slender; opaque brown, the posterior angles and borders of the segments ashy; the yellow of the venter sometimes encroaches upon the brown of the dorsum; sixth and seventh segments more distinctly yellow; the seventh and eighth segments with the posterior portion blackish. Legs yellow, less hairy than in A. flaveola. Wings hyaline, moderately hairy. Length 1.5 to 2.25 mm. St Vincent Island.

I have compared my male specimens with the cotype male specimen from the St Vincent collection of Cornell university, and cannot detect any differences.

Var. a. (fig.12). Male and female; agrees with Williston's description, excepting that there are but two reddish brown stripes in front (i. e. the usual middle stripe with a very slender dividing line); and all the abdominal segments are marked alike with ashy borders.

To Williston's description of the normal species the following may be added: The brown of each segment of the abdomen more intense just in front of the ashy posterior margin. The abdomen of the female is reddish brown, the incisures yellow and the margins of the segments ashy. Specimens from Ithaca, N. Y., and Pennsylvania.

20. Ablabesmyia pilosella Loew

1866 Tanypus Loew. Berl. Ent. Zeit. p.5

Female. Testaceous or subfuscous, with pale pile, the dorsum of the thorax without stripes, the scutellum, legs and antennae very pale, the last with long pile and toward the tip blackish, the wings thickly pilose, subcinereous, the basal cells short. Length 1 mm. Wing 1.2 to 1.3 mm.

Small, opaque, testaceous or subfuscous. The antennae ordinary, pale, blackish towards the tip, clothed with very long pile, the last joint not thickened. The dorsum of the thorax without

the usual stripes, sometimes whitish; scuttellum pale. Legs and halteres whitish; wings thickly pilose, subcinereous, the costal margin somewhat yellowish, the basal cells short. Translation. (Loew.) District of Columbia.

Through the kindness of Mr S. Henshaw of Cambridge, Mass., who examined the type for me, I may add that the fork of the cubitus begins before the M-Cu. crossvein; the basal cells are short, one third or less than the wing in length, and the abdomen is brownish.

21. Ablabesmyia tibialis Staeger

1845 Tanypus Staeger. Groenl. Antl. Nat. Tids. 2 den. R. B. I. 354

Blackish; halteres and legs pale fuscous, hind tibiae of the male long pilose; wings grayish, hairy. Length 2.5 mm.

Male. The blackish body is without markings; thorax dark; abdomen is somewhat shining and fuscous haired. The legs are sordidly yellowish brown, sparsely haired; the tibiae, particularly the hind pair, are long-haired. The wings are covered with gray hairs; the vein R_1 runs parallel with the wing margin and ends one third the wing length from the tip, R_{4+5} ends near the tip, the oblique R-M crossvein being near the middle of the wing; the media is slender and ends at the wing tip; the fork of the cubitus lies directly under the R-M crossvein; the M-Cu. crossvein is vertical (its position is not stated by Staeger); the branches of the radius are stout, but the cubitus and the anal veins are nearly invisible.

Lundbeck (1898) p.294 describes the female as follows:

Female. Resembles the male, but the abdomen is shorter and stouter; the wings are wider and the veins are a little stouter; with long pile on the hind tibiae, though not so long as that of the male; in other respects like the male.

Greenland (Staeger and Lundbeck).

22. Ablabesmyia fastuosa n. sp.

(Pl.19, figs. 16–19)

A single larva from Eddy pond, Ithaca, N. Y., in April.

Larva. Reddish, length about 7 mm. Head brown, rather short; about 1½ times as long as wide; antennae more than twice as long as the mandible. The basal joint about two thirds of total length (fig.17). Mandible resembles that of monilis, but with a broader lateral tooth (fig.16). Maxilla prominent with long palpus, hypopharynx and labium like that of monilis; the latter, however, has teeth in the middle shorter than the lateral ones, while the former has the teeth nearly equal in length.

Feet as usual, all claws of the same brownish color. Dorso-anal papillae with six to eight setae. Blood gills as in m o n i l i s.

Pupa. Pale fuscous. Length about 4 mm. Breathing trumpet (fig.18) about three times as long as broad, with large apical aperture, its surface spinose scaled. The surface of the abdomen under a very high magnification appears finely punctate. The lateral margin of the last two segments with the usual 4 or 5 filaments. The caudal fin (fig.19) has two pointed lobes, the surface covered with minute spinose scales.

Imago. Female, fuscous, legs and wings unmarked, the latter hairy and with darkened crossvein. Length about 3 mm.

Head, including palpi, proboscis, and antennae fuscous; eyes black. Thorax, including pectus, pleura, scutellum and metanotum fuscous; the dorsum, with the humeri, space in front of scutellum and three fine longitudinal lines more cinereous, in some lights the other parts appear more cinereous. Hairs dusky, abdomen fuscous, posterior margins of the segments cinereous; the hairs pale. The legs pale fuscous; the extreme tips of the tibiae darker. Fore metatarsus 0.6 as long as its tibia. The wings subhyaline, hairy, unmarked, crossveins and the radius darker than the other veins, crossveins specially distinct, R_2 present; cubitus forks a little proximad of the crossvein. Halteres white. Bred specimen. Ithaca, N. Y. Michigan. A specimen from Pullman, Wash., has dorsum of thorax and scutellum yellowish, the three dorsal stripes distinct, dull brownish black.

23. Ablabesmyia hirtipennis Loew.

1866 T a n y p u s Loew. Berl. Ent. Zeit. (Centur. VII). p.5

Female. Wholly fuscous, wings about the same color, thickly pilose, crossveins black, all of the tarsal joints linear. Length 3.5 to 3.8 mm. Wing 4.1 to 4.2 mm.

Fuscous; antennae, the posterior margin of each of the abdominal segments and the femora, excepting the tip, rather paler, palpi darker; the tarsi long in proportion, dark fuscous toward the tip, all its joints linear, decreasing in length, the last one shorter than the one preceding. Wings cinereous fuscous, thickly covered with long fuscous pile, the veins as is usual with the species of this genus, the crossveins black, the others subfuscous, R_{4+5} running into the margin of the wing near its tip. Translation. Maine.

Mr. S. Henshaw of Cambridge, Mass., who kindly examined the type for me, writes that the fork of the cubitus begins proximad of the crossvein, the halteres are luteous, and the thorax is striped.

24. Ablabesmyia nigropunctata Staeger.

1839 Tanypus Staeger. Kröjer; Nat. Tidsskr. 2:589, 16
1850 Tanypus Zett. Dipt. Scand. 9:3624
1864 Tanypus Schiner. Fauna Austr. 2:621

Male and female. Whitish; antennae pale; eyes black. Thorax in dried specimens yellow, in life with a reddish tinge; dorsal stripes pale; sternum and metathorax yellow; scutellum white. Abdomen whitish, slender in the male, pilose, the last three segments a little wider, each segment with a brown, basal transverse fascia on dorsal surface, venter spotless; anal appendages white. Abdomen of the female stouter, pubescent, spotless. Wings white, spotless; hatleres white. Legs white; fore metatarsus about one fourth shorter than its tibia. Fore legs of the male without long hairs. Pullman, Washington.

25. Ablabesmyia (?) sp.

A larva from Beebe lake, Ithaca, N. Y., is yellow; 5 or 6 mm. long; resembles P. adumbratus in having a short head, comparatively short antennae and in shape of the mandible; but differs in having but four marginal teeth in the labium (pl.19, fig.5) and in having rather more slender marginal claws in the posterior feet.

Genus 18. Isoplastus Skuse.

Proc. Linn. Soc. N. S. W. p.279. 1889

Antennae in the male 15-jointed, in the female 12-jointed. Wings pubescent. Marginal crossvein (R_2) and second longitudinal vein (R_3) pale and indistinct. Fork of the cubitus with its base at base of M-Cu. crossvein.

This genus was erected to contain several Australian species. It may later be found that this genus can not be separated from Ablabesmyia in which case the name Isoplastus has precedence.

Genus 19. Tanypus Meigen.

Illiger's Magaz. (part.) p.261. 1803

One of the subdivisions of the old genus Tanypus of Meigen. Wings hairy; cubitus forks distad of the M-Cu. crossvein, and is therefore petiolate.

Skuse (1889) gives the name Tanypus to the group having hairy wings and the fork of the cubitus sessile; but since Meigen gave the species cinctus (=punctipennis) as the representative of the genus, and since it possesses a petiolate cubitus,

it appears to me that the name should be retained for species having this character.

KEY TO SPECIES OF TANYPUS

Imagines

a Wings clouded (banded or spotted)

b Legs nearly uniform in color; wings uniformly spotted with fuscous; thorax with three dusky stripes; legs yellow; length 4.5 mm.; female ..... Ablabesmyia pictipennis

bb Legs distinctly bicolored. Femora brownish with white subapical rings; abdomen blackish (New York and Texas)....1. stellatus

aa Wings not clouded, excepting sometimes the crossveins or a faint smokiness near apical end; dusky species

b Halteres pale fuscous; blackish species; legs sordidly yellowish brown; wings grayish, hairy; tibia long-haired; thorax dark; abdomen somewhat shining and fuscous haired; anterior crossvein in the middle of wing; length 2.5 mm. (Greenland)

21. Ablabesmyia tibialis

bb Not as above

c Scutellum black; legs usually brownish or black

d Apical half of wing smoky; abdomen brown..4. culiciformis

dd Apical half of wing not smoky

e Thorax gray with black stripes; abdomen cinereous black; M–Cu crossvein far proximad of the fork of the cubitus; halteres sordidly yellow; fore metatarsus but little more than half as long as the tibia; length 2 to 3.25 mm.

2. posticalis

ee Thorax with lateral ferruginous stripes; crossveins clouded; fore metatarsus about three fourths as long as its tibia; length 4 mm.....3. crassinervis

cc Scutellum yellowish; legs usually paler brown or yellow

d Apical half of wing distinctly smoky, especially near the anterior margin; abdomen dark brown; length 3.5 to 4.5 mm. (New York) .....4. culiciformis

dd Wing nearly hyaline; abdomen with whitish incisures

5. choreus

The species pictipennis and tibialis Staeger have been included in the foregoing as well as in the key for Ablabesmyia because there is some doubt as to the position of the M-Cu. crossvein. They are, however, described with Ablabesmyia.

Tanypus tibialis Say (6) and Tanypus balti-moreus Macq. (7) are not sufficiently described to place in the keys; both of these descriptions are reproduced in the body of this work. Tanypus annulatus is a synonym of A. monilis, and T. decedens Walker is perhaps the same as pictipennis Zett.

1. Tanypus stellatus Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:89

Yellowish brown, antennae except the basal joint pale yellow, abdomen blackish, a whitish ring at three fourths the length of each femur, tibiae except each end, and tarsi except apices of the joints, light yellow, halteres light yellow; mesonotum thinly grey pruinose; wings covered with brown hairs, whitish hyaline, marked over nearly the entire surface with many brown spots, several of which are confluent and enclose small whitish spots; costal cell except at its apex brown; R_1 near its apex connected with R_3 by the oblique R_2, cubitus forks a short distance beyond the crossvein; length 2 mm. Female. Texas, Kansas, New York.

Some male and female specimens captured in Ithaca, N. Y., I have identified as this species. The females agree very well with the description given by Mr Coquillett; the descriptions of the specimens are as follows:

Male. Head, palpi and basal joint of antenna fuscous, the antenna and its hairs a trifle paler. Dorsum of thorax with three dull dark-brown stripes, the middle one divided; the fine lines separating the dark dorsal lines, the lines separating the dark humeral spots from the lateral lines, the anterior margin, and the posterior margin of the middle line, cinereous white. The two minute tubercles of the collar sometimes pale. Metanotum, pleura and sternum, dark brown; scutellum a little paler. Hairs pale. Abdomen dull brown, the posterior margins of the segments whitish. Claspers short, stout, and dark brown. Coxae brown, each femur brown, with a white ring not far from the apex, each tibia yellow with brown base and tip, tarsi yellow, joints black at tip, last joint darker; fourth tarsal joint slender, and longer than the fifth. Wings with many brown spots, that upon the crossveins most conspicuous. Two near the tip of R_1, one on the humeral crossvein, one dark one on the median crossveins, four in cell R_{4+5}, each divided longitudinally by a wing fold; two or three in the cell M; one or two between branches of the cubitus; and several in the anal cell. Venation as shown. Halteres sordidly yellow, the knobs somewhat infuscated, their tips paler. Length 3 mm.

Female. (Pl.27, fig.7.) Like the male, but the abdomen is usually wholly brown, occasionally the margins of the segments very narrowly whitish. Tibiae excepting the knees sometimes brown. Length 2 mm.

2. Tanypus posticalis Lundbeck

1898 Tanypus Lund. Vidensk. Meddel. p.295

Thorax black, shining, with two longitudinal cinereous stripes; or it may be described as having three wide black stripes, shining,

the median one posteriorly, the lateral ones anteriorly abbreviated, and the median one is divided by a fine line; the intermediate space and the lateral margins have some erect yellow pile; scutellum and metanotum black; abdomen slender, cinereous black, with long yellow pile, claspers quite large, pilose. Antennae blackish brown; legs more or less dilutely brown. Halteres sordidly yellow. Wings hyaline, distinctly but not densely hairy, the costal vein brown, the others pale, the cubitus forks far distad of the M-Cu. crossvein (pl.37, fig.20). The second and third pairs of legs with long pile, the first pair bristly, the fore metatarsus a little more than half the length of its tibia. Male. Length 2 to 3.25 mm.

The female is shorter than the male, stouter, the antennae shorter than the thorax; in other respects like the male. North Greenland.

3. Tanypus crassinervis Zetterstedt

1838 Tanypus Zett. Ins. Lappon. 817. 1
1845 Tanypus Zett. Staeger. Nat. Tids. p.354
1850 Tanypus Zett. Dipt. Scand. 9:3599
1898 Tanypus Zett. Lundbeck. Vid. Med. p.294

Black, opaque, halteres whitish, lateral margin of the thorax ferruginous, antennae brown, wings white, somewhat hairy, anterior veins conspicuous, crossvein infuscate, R_2 present, the fork of the cubitus petiolate; legs blackish or fuscous, fore tarsi bare, metatarsus about one fourth shorter than the tibia. Length about 4 mm.

Male and female. Resembles P. nervosus (an European species) but is a little smaller, the body opaque, not shining, the wings with pale hairs, and the legs unicolored. Head black; antennae dark, the hairs (in the male) brownish; palpi dark, thorax black, lightly cinereous shining, dorsum of the thorax in the male with a lateral ferruginous stripe, the humeral spots sometimes more distinct; in the female often reddish yellow, with three wide black stripes, the lateral ones abbreviated anteriorly. Scutellum and metanotum black. Abdomen black, in the male pilose, genitalia small, ovate; abdomen of the female pubescent. Wings white, slightly hairy, anterior veins distinctly fuscous, crossveins more deeply infuscated, the posterior veins distinct but paler. Venation as in P. nervosus (pl.37, fig.24). Legs formed as in the latter, sometimes brown, sometimes fuscous testaceous. An European species, also recorded from Greenland by Staeger (1845) and Lundbeck (1898).

4. Tanypus culiciformis Linne

1767 Tipula Linn. Syst. Nat. ed. XII. 2:978
1805 Chironomus Fabr. Syst. Antl. 47, 44

1818 Tanypus Meig. Syst. Beschr. 1:63, 13
1850 Tanypus Zett. Dipt. Scand. 9:3610, 17
1864 Tanypus Schin. Fauna Austr. 2:617
1877 Tanypus V. d. Wulp. Dipt. Neerl. 299, 4
1826 Tanypus fasciatus Macq. Rec. Soc. Sc. Agri. Lille. 187, 5
1838 Tanypus tenuis Meig. Syst. Beschr. 7:15, 34

Male. Head dark brown, including mouth parts and antennae. Dorsum of the thorax with three dark brown stripes, the middle one divided by a fine line. Humeri and scutellum yellowish brown, sternum and metanotum and sometimes scutellum also, blackish; the pleura a little paler. Abdomen dark brown, the posterior margins of the segments paler, more yellowish; hairs brown. Genitalia short and robust (pl.32, fig.2). Legs yellowish or brownish; the tips of the femora, tibiae, and all the tarsal joints darker. The metatarsus usually yellowish. Fourth tarsal joint linear and longer than the fifth; the fore metatarsus about one fourth shorter than the tibia; the fore tarsi and the posterior legs somewhat hairy, wings hairy, hyaline, the apical half smoky, especially near the anterior margin; crossveins dark clouded, R_1 with R_2 near its tip, the petiole of the cubitus about one half as long as the fork (pl.27, fig.15). Halteres white.

Female. Antennae except apical joint yellowish; the humeri paler and the legs less hairy than in the male. Length 3.5–4.5 mm.

A number of specimens from Ithaca, N. Y., one from Riverton, N. J., one from Idaho, and one from Chicago, Ill., I cannot distinguish from European specimens.

5. Tanypus choreus Meigen

1804 Tanypus Meigen. Klass. 1:23, 6
1818 Tanypus Meigen. Syst. Beschr. 1:62, 12
1839 Tanypus choreus Meig. Staeger. Nat. Tids. 2:585, 7
1850 Tanypus Meig. Zett. Dipt. Scand. 9:3609. 15
1864 Tanypus Meig. Schin. Fauna Austr. 2:617
1877 Tanypus Meig. V. d. Wulp. Dipt. Neerl. 299, 5
1804 Tanypus fasciatus Meig. Klass. 1:21, 3
1804 Tanypus sylvaticus Meig. Klass. 1:24, 9

Antennae brown, including the antennal hairs of the male; palpi more or less brown. Thorax brown, with three darker longitudinal stripes, the spaces between the longitudinal stripes and the flattened area in front of the scutellum whitish; sternum greyish; scutellum yellow; metanotum black. Abdomen brown-black with whitish incisures; venter yellow anteriorly; the anal segment of the male broad and flattened, the claspers short, yellow basally, blackened toward the tip. Legs yellowish brown; the tips of the femora and of the tibiae and the whole of the last four tarsal joints brown; the first joint of the fore tarsus is

one fourth shorter than the tibia; fore tarsi of the male bearded. Halteres whitish. Wings slightly hairy, hyaline, slightly smoky near the tip; the crossvein brown clouded; the cubitus forking distad of the crossvein; venation resembling that of P. nervosus (pl.37, fig.24).

The female is usually somewhat lighter colored. Length 3.5 to 4.5 mm. Translation from V.d. Wulp (1877). "Coloring somewhat variable." Schiner (1864). North America (Osten Sacken, 1878).

6. Tanypus tibialis Say.

1823 Tanypus Say. Journ. Ac. Nat. Sc. Philad. 3:15, 2
1828 Tanypus Wied. Ausser. Europ. Zw. Ins. 1:20, 4
1878 Tanypus Ost. Sack. Catl. Dipt. N. A. p.22

Thorax reddish brown; tibia white at base; abdomen white, a double band on the middle and tip black. Habitat: Pennsylvania.

Wings immaculate; poisers white; feet fuscous, basal half of the tibia white; tergum, second joint with a spot each side, two middle segments with each a band, of which the anterior one is much broader, and terminal segments deep fuscous, pleura yellowish. Length of male more than 1/20 in.

7. Tanypus baltimoreus Macquart

1855 Ternipus Macq. Dipt. Exot. Suppl. V. 15, 1
1878 Tanypus Ost. Sack. Catl. Dipt. N. A. p.21

Female. Palpi tawny, shining cinereous. Antennae wanting. Thorax with wide black bands; abdomen black, posterior margins of the segments white. Legs tawny; tarsi dusky. Halteres brown. Wings greyish, with an obliqne black line; veins normal. Length 3.5 mm. From Baltimore. Translation.

Judging from the description this species seems to resemble T. culiciformis, but it has brown halteres. Nothing is said either about the wing venation with respect to fork of the cubitus, whether sessile or petiolate; or whether the wing is hairy or bare; it is therefore impossible to say to which one of the four genera of the group Tanypus it belongs.

Genus 20. Pentaneura Philippi

Verh. z. b. Ges. 35. 629. 1865

The antennae equal in length to the head and thorax taken together, moniliform, 12-14 jointed, verticillate with long hairs, the joints subglobose, not petiolate, the last joint elongate. Palpi elongate, equaling the antennae, joints subcylindrical. Wings

narrow, very hairy, venation as shown on pl.37, fig.16. Legs hairy, elongate, especially the tarsi; first tarsal joint equal to the two following in length; fourth and fifth together equal to the third. Type, P. g r i s e a Ph. Chile. No North American species.

Genus 21. Podonomus Philippi

Verh. z. b. Ges. 7. 601. 1865

Thorax strongly produced over the head. Antennae of the female short, subcylindrical, verticillate with long hairs, eight (?) jointed, the last joint equal to the two or three preceding (pl.37, fig.10). Venation as shown on pl.37, fig.11. Legs elongate, equal, tarsi elongate, the metatarsus about the same length as the tibia, the second about one half as long as the first, the remaining ones short and of equal length. Type, P. s t i g m a t i c u s. Chile.

From the wing venation it appears that this genus is related to the group T a n y p u s. No North American species.

Genus 22. Heptagyia Philippi

Verh. z. b. Ges. 41. 635. 1865. (Pl.37, figs. 21, 22, 23)

Head small. Antennae short, 7-jointed, cylindrical, first joint large and thick, the following subequal, the last one oblong, equaling the two preceding ones taken together. Ocelli none. Palpi long, 6-jointed, almost exceeding the antennae, first three joints subcylindrical and equal, the fourth and fifth shorter and subglobose, the last one slender, oblong, equalling the fifth one in length. Thorax very much swollen, with a deep suture near and parallel to the anterior margin. Wing venation as shown in fig.21. Legs elongate, slender, anterior femora not thickened, not armed, anterior tibiae with unarmed extremities, posterior tibiae with minute apical spines; tarsi elongate, first joint nearly equalling the remaining ones in length. Type, T. a n n u l i p e s Ph. Chile. No North American species.

Genus 23. Corynocera Zetterstedt

I n s e c t a l a p p o n i c a 856. 1838

Head moderately large, transverse; antennae porrect, shorter than the thorax, arcuate, cylindrical, about 12-jointed; the first joint short, thick, bare, the following 10 very small, rounded, closely sessile, delicately haired, the 12th elongate, conical, wider,

bare; palpi slightly projecting, bent, proboscis short; eyes round, somewhat prominent, remote; front wide; ocelli wanting; dorsum of thorax elongate, arched, higher than the head, no transverse suture, somewhat depressed in front of the scutellum; scutellum small. Abdomen 7 or 8 jointed. Legs short, robust, of unequal length, wholly bare and unarmed; coxae not elongate; halteres short. Wings as long as the abdomen, club-shaped, rather narrow, bare, with 4 or 5 discal veins diverging apically, all very indistinct; on the anterior margin at the apex is a long somewhat curved seta; the posterior margin is not ciliate. The wings of the female are shorter than the abdomen, the genitalia of the male clubbed, legs more robust; the abdomen of the female pointed, with two short appendages. Metamorphosis and life history unknown. Translation from Schiner p.641 (1864).

The only species of this genus is C. crassipes Zett. (=ambigua Zett.), a small, brownish black fly, with pale legs, whitish wings and halteres. Length 2 to 2.25 mm. Lapland and Germany (Beuthin).

Genus 24. Spaniotoma Philippi

Verh. z. b. Ges. 35. 629. 1865. (Pl.37, figs. 13 and 14)

Thorax prominent above the head. Antennae short, scarcely exceeding the palpi in length, 6-jointed, the joints oval, sparsely verticillate with short hairs, the last joint rather acute. Palpi 4-jointed, the first joint thickened, the last one slender, elongate, divided (?).

The wing venation (fig.13) resembles that of Chironomus (sens. lat.) though the crossvein is rather nearer to the base of the wing than in the typical Chironomus. The description does not state whether the wing is hairy or bare. The figure given by Philippi shows the fore metatarsus shorter than its tibia. The genus may possibly be synonymous with either Metriocnemus or Orthocladius.

Type S. bivittata Philippi, Chile. No North American species.

Genus 25. Corynoneura Winnertz

Stettin. Ent. Zeitg. 7:12. 1846. (Pl.36, fig.7, and pl.32, fig.4)

Small species, distinguished by the absence of the anal angle of the wing. Head round, proboscis short, palpi incurved, four-

jointed, the last joint elongated. Antennae of the male 10-jointed, the first joint thick and disk-like, the following eight egg-shaped, the last one thicker and longer than the others, all with long hairs, the last one verticillate; antennae of the female 6-jointed, the first one thick and disk-like, the following four ellipsoidal, the last one somewhat elongate, all with short hairs. Eyes round, ocelli wanting. Mesothorax greatly arched, prolonged over the head, without transverse suture; scutellum small; metathorax much arched. The 8-jointed abdomen is narrow and long. Legs elongated; slender; the posterior pair of tibiae somewhat thickened, spurred; metatarsi elongated; claws and pulvilli very small. Wings in outline club-shaped, bare, and bent down; anal angle wanting; anterior margin thickened. Halteres free; venation as shown on pl.36, fig.7. Genitalia of male shown on pl.32, fig.4 (after Kieffer). Antennae of male 11-jointed according to Kieffer (1899).

Of the larvae and pupae of the members of this genus, but one species has been described as far as I am aware; i. e. Corynoneura lemnae Frauenfeld (1866). (Pl.36, figs. 1 to 5.) He describes the larvae as filiform, thickened anteriorly, white, with distinct incisures (fig.1). The chitinous pale brown head is oval, with two black eye spots. The antennae 3-jointed 1.5 times as long as the head. The first thoracic segment is in the form of a truncated cone, upon the ventral side of which is a cephalad projecting process, with a bilobed extremity, each lobe possessing a crown of delicate setae. The next thoracic segment largest, with two oval, stigma-like spots on each side. The following 8 gradually decreasing in size; the last is nearly cylindrical, and has upon the dorsal surface a prominence upon which there are several upright setae. There are two anal blood gills and two prominent anal prolegs, at the extremity of each of the latter there is a circle of curved setae. Length 3.7 mm.

The pupa is described as being smooth and pale yellow in color; the wing sheaths being one third of the entire length. The abdominal segments are distinct; the anal end is blunt, upon each side with a hyaline crescent-shaped disk, each with 8 long setae upon its margin (fig. 4 and 5). Length 1.2 mm. The imago resembles C. scutellata Winn. (an European species).

1. Corynoneura atra Winnertz

1852 Corynoneura Winn. Stett. Ent. Zeit. 13, 50, 4
1864 Corynoneura Schiner. Fauna Austr. 2:594

Male. Dorsum of thorax velvet-black; pleura sordidly yellow. Abdomen dark brown. Head black; antennae brown, with brown, shimmering whitish hairs; palpi yellow; legs whitish with dark articulations, last three joints of the hind legs brown. Wings shimmering milky white. Length .8 mm. Europe and Greenland according to Lundbeck (1898).

The male genitalia is shown on pl.32, fig.4 (after Kieffer).

2. Corynoneura celeripes Winnertz

1852 Corynoneura Winn. Stett. Ent. Zeit. 13, 50, 3
1864 Corynoneura Schiner. Fn. Austr. 2:594

Female. Yellow; dorsum of thorax with three broad black longitudinal stripes, the laterals anteriorly abbreviated; pleura and metanotum blackish brown or black. Abdomen black with delicate, whitish incisures; venter sordidly yellow, blackened apically. Head black; palpi and antennae yellow, the apical joint of the latter brown. Legs whitish, with dark articulations, the last three joints of the hind tarsi blackish brown. Wings shimmering whitish. Length 0.8 mm. Europe and Greenland according to Lundbeck (1898). This species is supposed to be the female of C. atra. See Lundbeck (1898) and Kieffer (1902).

A single female specimen reared from a larva found in pond water (Ithaca, N. Y.) agrees with the above description, excepting that the pleura are yellowish.

Genus 26. Wulpiella Kieffer

Bul. Soc. Ent. France. p.66. 1899

Small species having 4-jointed palpi; antennae of female 6-jointed, the 4 intermediate joints verticillate with very long hairs. Tarsal claws simple; metatarsus shorter than its tibia. Wings hairy, the venation as in Chironomus (pl.34, fig.20). The type is W. scirpi Kieffer, an European species. No North American species.

In a note on p.824 of Ann. Soc. Ent. France (1900) the author states that in the figure given by him the crossvein has by mistake been omitted.

The larva is yellowish white, with dark head; length 4 mm. It has black eyes at the anterior angles of the head; a pair of short three-jointed antennae, mandibles four or five toothed, and a

seven to nine toothed labium. Thoracic and anal prolegs present, the latter with prominent retractile claws (fig.22). The caudal papillae are cylindrical, pointed apically, each with three short and three long setae. (Plate 34, figs. 21, 22, 23.)

Genus 27. Limnophyes Eaton

Ent. Monthly Mag. 60. 12. 1875. (Pl.37, figs. 1, 2, 3, 4)

Imago. Head small, ovately triangular; eyes roundly oval, hardly reniform; ocelli absent; antennae divergently porrect, filiform, 6-jointed, with sparse verticils of spreading hairs (fig.3), the basal joint very stout, the second much smaller than the first, but yet slightly thicker than the remaining joints, which are of even width, the apical joint as long as the preceding two together; mouth short, the margin hairy, palpi 4-jointed (fig.2). Thorax robust, above arched anteriorly and produced like a hood over the head (fig.4); its contour viewed from above is somewhat ovate, and it has about four longitudinal rows of short, fine, sparse hairs ascending upwards and inwards; scutellum moderately large, prominent, semicircular or roundly subquadrate. Wings oblong (fig.1), suddenly constricted at the base, rather straight along the costa, the apex almost parabolic, the margins ciliated. The subcostal vein very short, becoming obsolescent in the subcostal area, the radius two-branched, R_1 extending beyond the middle of the costa, the media united by a crossvein to the radius just proximad of the point of furcation; R_{4+5} like R_1, accompanied by a slight crease in the membrane; the cubitus rather deeply forked, the furcation acute, similarly accompanied by a crease which follows its lower branch; this last branch is succeeded by one or two longitudinal folds simulating additional veins (anal veins ?). Halteres large. Legs slender, with fine short hairs; tibiae almost scabrous, with a minute spine at the apex interiorly; the first tarsal joint much longer than the next. Abdomen slender, 8-jointed, with a few hairs above; ovipositor formed of two very short lamellae. Larvae not observed.

In the original diagnosis it was stated that the number of joints in the palpi and abdomen were respectively 5 and 7. It appears to be more correct to regard them as being 4 and 8 jointed. The antennal joints are very likely to vary in number with the sex, and to be more numerous in the male than in the female.

The above description is copied from Verrall's paper in Phil. Trans. p.245, vol.168, only the nomenclature of the wing veins being changed. The figures 1 to 4 on plate 37 are also taken from Verrall, and illustrate details of the species L. pusillus Eaton, a small gnat found at Royal Sound, Kerguelen Island. No North American species.

Genus 28. Chasmatonotus Loew

Berl. Ent. Zeit. p.51. 1864

This genus is related to Hydrobaenus but differs from it in that the palpi are longer, and the flagellum of the antenna is composed of 5 joints in both sexes (i. e. antenna 7-jointed), see pl.31, fig.6. The dorsum of the thorax has a narrow fissure which widens posteriorly in a flat area in front of the scutellum (pl.31, fig.16); hence the name. The wings of our three American species are black with white markings.

KEY TO SPECIES OF CHASMATONOTUS

Imagines

a Wing with two prominent white spots (pl.27, fig.16); the larger near the base of the wing, the smaller subquadrangular, in the fork of the cubitus, a little distad of the middle of the wing (New York, Illinois) 1. bimaculatus

aa Wing not marked in this way

b Wing with a longitudinal vitta between the media and the cubitus; thorax black with front corners, and hind end, and a part of the pleura yellow; abdomen with posterior margins of the segments whitish (Alaska).....2. univittatus

bb Wing with a broad transverse band extending from the radius to the posterior margin (New York).....3. unimaculatus

1. Chasmatonotus bimaculatus Osten Sacken

1877 Chasmatonotus O. S. Bul. U. S. Geol. Surv. 3:191
1878 Chasmatonotus O. S. Catal. Dipt. N. A. p.22

Male. Black; wings of the same color and with two large white spots. Length about 1.5 mm.

Black; thorax shining; base of the abdomen laterally pale greenish yellow; feet black; front coxae and base of all the femora yellowish; the first tarsal joints are of the same pale yellowish color except the tip, which is black. Knob of halteres greenish. Wings black; the first white spot is in the shape of a cross band between the second vein and the anal angle; second spot is square, and situated on the hind margin, within the fork of the cubitus, pl.27, fig.16, pl.31, figs. 6 and 16, pl.32, fig.6.

The first posterior cell and the cell within the fork of the cubitus are much longer than in C. unimaculatus Lw., and the latter cell is longer and broader. Hence it happens that although in both species the cross-band-like spot is placed immediately inside of the proximal end of the fork it occupies the middle of the wing in C. unimaculatus, and is much nearer the base in C. bimaculatus. The abdomen of the male ends in a comparatively large and conspicuous forceps (the "hypopygium maris globosum" in Mr Loew's description of C. maculatus seems to indicate a different structure?). (O. S. loc. cit.)

Catskill mountains and Quebec (Osten Sacken 1877). Several male specimens from Lake Forest, Illinois, received from Professor Needham. New Jersey (Johnson, 1904).

2. Chasmatonotus univittatus Coquillett

1900 Chasmatonotus Coquillett. Proc. Wash. Acad. Sc. 2:395

Male. Black; the bases of antennae, front corners and hind end of thorax, pleura, except the lower portion and one or two spots; halteres, trochanters, and bases of femora and of tibiae, yellow; posterior margins of abdominal segments whitish, mesonotum polished; abdomen subopaque; wings black, the extreme base and a vitta extending from it three quarters the length of the wing, between the medial and cubital veins, white; length 2.5 mm. Sitka, Alaska.

3. Chasmatonotus unimaculatus Loew

1864 Chasmatonotus Loew. Berl. Ent. Zeit. 50
1878 Chasmatonotus Loew. O. S. Cat'l. Dipt. N. A. p.22

Male and female. Black, with black wings, having a whitish spot on posterior margin. Length 2 mm.; wing 2 mm.

Head black, the eyes in both sexes separated by a wide shining front. Proboscis short, black; palpi black, four-jointed; the first joint short, the next two moderate, the second clavate; the third stouter; the fourth linear, a little longer than the preceding. Antennae fuscous black, short, in both sexes alike; the basal joint globose; the five joints of the flagellum short pilose, the first joint cylindrical, the three following short ovate, the last oval. Thorax black, the dorsum shining, the pleura opaque; scutellum the same color. Abdomen black, subopaque, the first segments in the female lurid; hypopygium of the male black, globose. Legs black, the bases of the femora sordidly yellow and the tarsi in immature specimens cinereous. Halteres black. Wings black, with a subtriangular white spot extending from the posterior margin as far as R_{4+5} of the wing. New Hampshire (O. S.)

Genus 29. Telmatogeton Schiner

Verh. zool. bot. ges. Wien. 16-931:1866

The larva and pupa have not been described as far as I am aware, but figures of both are given by Schiner (1868) of an East Indian species T. St. Pauli Schiner. These figures are reproduced on pl.34, figs. 12, 13, 14 and 15.

Imago. Head small and deeply set; the thorax highly arched, robust, rising abruptly behind the head; the abdomen is short and slender; the wings long and of uniform width, extending far beyond the abdomen; the legs are much elongated. Eyes oval, in both sexes widely separated by the deeply excavated front; the ocelli are wanting; palpi 4-jointed, the basal joint small, the following ones of equal length, thickly haired; antennae in both sexes alike, 7-jointed, scarcely as long as the head, the first joint extraordinarily large and thick, the second one slender, the next four disklike, much wider than long, closely joined, the apical joint elongated, somewhat thickened at the base, gradually becoming smaller towards the tip; the basal joint hairy above and below, the others bare. Metathorax strongly developed; the scutellum small; abdomen 7-jointed; male genitalia two-lobed, the lobes closely connected, not spreading or forceps-like; ovipositor of the female pointed; the upper sheath longer than the lower one. Legs long and slender, particularly the hind pair. At the end of each of the tibiae is a pair of short spines, and at the apical end of the metatarsus is a single one; the metatarsus is elongate the second joint scarcely one half as long as the first, the third less than two thirds as long as the second, the next two each half as long as the third; the claws horny, well-developed, furcate at the extreme tip; pulvilli small but well-developed; the empodium large, filling the space between the claws, ciliated at the apical end. Wings long, the anal angle right-angled, the posterior margin nearly parallel with the anterior margin; the subcostal vein running parallel to the costa but not reaching the margin; the cubitus forks proximad of the middle of the wing, its lower branch not quite reaching the margin, anal veins quite short (pl.34, fig.16). Halteres long with a broad knob. The type of the genus is T. St. Pauli Schiner (loc. cit.). A small blackish fly with dusky wings from the Island of St Paul in the Indian Ocean.

One species of this genus has been described from North America T. alaskensis Coq. (1900). The venation of the American species differs slightly from this description. See below.

Telmatogeton alaskensis Coquillett

1900 Telmatogeton Coquillett. Proc. Wash. Acad. Sc. 2:395

Male. Head and its members brownish black, the front velvet black, first joint of antennae velvet brown; antennae about as long as the head, the first joint nearly three times as wide as the others, the latter subcylindrical, the last joint slightly longer than the others and subconical in profile; thorax opaque black, the lateral margins and upper part of pleura varied with yellowish, scutellum, metanotum, and abdomen brownish black, the lateral margins of the latter and hind margins of the ventral segments yellow; coxae mottled black, brown and yellowish, the remainder of legs blackish brown, front femora each bearing a transverse, contiguous pair of blunt tubercles near the tip of the under side, and just beyond them a pair of rather widely separated cavities; front tibiae each bearing a blunt tubercle on the under side near the base, the inner side of each front tibia rather strongly dilated at its first third; first joint of the tarsi nearly three times as long as the second; each of the last three joints slightly over one half as long as the second joint, claws cleft almost to the middle; halteres whitish; wings brownish gray, veins brown, first section of the media yellow, bases of the branches of the radius nearly coalescent; length 4.5 mm. Yakutat, Alaska.

This species agrees very well with Dr Schiner's description and figures except in the structure of the legs, but these are not sufficiently different to warrant the establishing a separate genus for the present form. Coquillett (loc. cit.) Specimens also from Oregon and California. In these specimens the cubitus forks immediately under the crossvein, the latter oblique, the subcosta reaches the wing margin slightly distad of Cu_2. Length 4 to 6 mm.

Genus 30. Macropeza Meigen

Syst. Beschr. 1:87. 1818. (Pl.35, figs. 1, 2, 3)

Small, blackish gray species, with long wings and extraordinarily long legs. Head small; transversely oval; the proboscis and palpi short, antennae 15-jointed; the second basal joint quite large and thick, the other joints peculiarly arranged, the first seven each small at the base and widened toward the end;

the next small, the following ones again, slender and elongate, the last one small; these are all only thinly haired (fig.3). The eyes round, bare, the ocelli wanting (or rudimentary?); front broad. The arching of the thorax gradually becomes greater from the head backward, the transverse suture wanting; scutellum short but wide; metathorax moderately large. Abdomen 8-jointed, hypopygium somewhat projecting. Legs long; coxae not elongated, the fore femora shortest, the posterior pair longest; tibiae without spurs; tarsi of the posterior pair of legs extremely slender, and at least as long as the femora and tibiae taken together, the metatarsus about twice as long as the following joints taken together, apical joints small, the sole of the clawed joint bristly, the claws quite long and bent; the halteres prominent. Wings long and narrow; venation as shown in figs. 1 and 2. The first figure is from V. d. Wulp (1877) the second after Meigen (1818). No North American species have been described.

Genus 31. Hydrobaenus Fries

Vetensk. Akad. Handl., 1829. 176. 1830
Psilocerus Ruthe, Isis. XI. 1207. 1831

(Pl.34, figs. 2 to 11)

Fries (1830) describes the larva and pupa at considerable length and gives figures illustrating details of each; the latter are reproduced on pl.34, figs. 2 to 5 and 8.

Larva. The larva is described as being 4 mm. in length, greenish in color, quite slender, and cylindrical. The head (fig.2) is small, obcordate and black. The antennae are three-jointed. On the ventral side of the first thoracic segment is a pair of feet with setae (fig.3). On the dorsal surface of the eleventh abdominal segment are two cylindrical processes, the extremity of each with a tuft of long hairs. On the ventral surface of this segment are the blood gills, two in number and shorter than in Chironomus. The twelfth segment has the usual anal feet and four blood gills, the latter, however, differing from Chironomus in having at the apex of each a little tuft of hairs.

Pupa. (Figs. 5 and 8) Thorax with short and narrow respiratory tubes. The caudal end is provided with two tufts of long hairs. The species shown by Fries is H. lugubris, an European species.

Imago. Very small black species, the males as well as the females of which have the antennae with short hairs. Head small,

flattened in front; epistome somewhat prominent; proboscis not much extended; palpi short, four-jointed, the last joint somewhat longer than the one which precedes it; antennae of the male 14-jointed (fig.7); the basal joint thick, the last joint elongated and thicker than the rounded preceding joints, short and sparsely haired; the female with a 7-jointed antenna (fig.6), the first and last joint as with the male. Eyes crescent-shaped, the concave side enclosing the antennae, bare; ocelli wanting. Mesothorax produced over the head, well arched; abdomen narrow and long, 8-jointed, hypopygium small (figs. 10 and 11). Legs moderately long, covered with fine, woolly hair; the metatarsi somewhat elongated but not as long as the tibiae; claws distinct, puvilli very small. Wings shorter than the abdomen and with the cell M_1 open; anal angle rounded (fig.9). Halteres free. Fries' figure (copied on pl.34, fig.7) shows the male antennae with but 13 joints, although the description says there are 14.

This genus has not yet been recorded from America.

Genus 32. Doloplastus Skuse

Proc. of Linn. Soc. of N. S. W. 4:260. 1889

Antennae 2+6 jointed in male, otherwise as in female of Orthocladius. Wings naked. Third longitudinal vein (R_{4+5}) nearly straight. Costal vein extending a little beyond tip of third longitudinal (R_{4+5}). Posterior branch of fifth longitudinal (Cu_2) straight. Legs unicoloured. In fore legs the metatarsus considerably shorter than tibia. Forceps of male robust. An Australian genus.

Genus 33. Smittia Holmgren

Kongl. Svenska. Vetensk. Ak. Handl. Bd. 8. no.5. 1869. 47

Front wide, eyes oval, somewhat prominent, at the base of the antennae slightly emarginate. Antennae short, flagellum (female) sparsely haired, 5-jointed (i. e. antennae therefore 7-jointed), the first and the last joint longer than the others. Oral margin slightly produced, palpi rather stout. Thorax like that of other Chironomids. Abdomen somewhat blunt, the tip on both sides with a seta-like tubercle. Wings narrow, short, scarcely reaching the middle of the abdomen; venation much as in Chironomus, but more difficult to distinguish; stouter towards the costal margin. Legs rather long, fore femora stouter, the tarsi a little longer than the tibiae. This genus takes a position between

Diamesa and Chironomus, but easily distingnished from them by the short wings. Type of the genus S. brevipennis (=Chironomus brevipennis Boehem).

It is not stated in the description whether the wings be hairy or bare. From the statement that the tarsi are a *little* longer than the tibiae, it appears that the metatarsus is shorter than the tibiae. The genus may, therefore, be most nearly allied to Orthocladius, Camptocladius or to Metriocnemus. In the description given by the author in Ent. Tidskr. p.181, 1883, it is stated that the abdomen of the male is narrow and the anal end somewhat thickened almost like that of Diamesa. Genus has not been recorded from America.

Genus 34. Burmeisteria Weyenbergh

Tidj. v. Entomol. 130. 1886. (Pl.35, figs. 26-28)

Like Chironomus, but the thorax is narrowed anteriorly and bent downward overhanging the head (fig.27). The halteres are long and flat (fig.28), the stem very short, hence covered by the knob. Wings with ciliated margin (fig.26).

In the generic description given by Weyenbergh the number of antennal joints is not stated; although the statement "like Chironomus" would seem to imply that this genus possesses the same number as Chironomus (i. e. 14). Weyenbergh's figure also shows about this number. Arribalzaga (1893 p.241) states that the genus should be regarded as a synonym of Chironomus sens. str. and further says that the wings are bare.

The type of the genus is B. photophila Weyenb. (loc. cit.), recorded from Argentina. No other species have been recorded.

Genus 35. Diamesa Meigen

Syst. Beschr. 7:12. 1838. (Pl.30, fig.13, and pl.32, figs. 5 and 14)

Larva. The larvae of the known species are yellowish or greenish in color and are found in swiftly flowing water. In form they are of the usual Chironomid type, most resembling those of Orthocladius. The blood gills of the eleventh abdominal segments, which are usually found in Chironomus are wanting in this genus; their absence probably due to the fact

that the larvae are found only in well aerated water. When taken from the streams and placed in still water they soon die, usually within a few hours. (Pl.36, fig.11-25, after Heeger; 1853; and pl.20, fig.9).

Pupa. The pupae are apparently without thoracic breathing organs; if they are present they must be extremely minute and have been overlooked. The anal end with 6 or 8 short setae; the posterior margin of each abdominal segment with spines or setae. (See pl.48, fig.13, in Bul.68, N. Y. State Museum, '03.)

Imago. Head small; broad and flattened in front, the face prolonged into a short broad proboscis; eyes elongate, only a little emarginate, ocelli wanting. Antennae inserted close to the eye margin, 14-jointed in the male, basal joint broad and disk-like, the fourteenth very much elongated like that of the males in Chironomus and of a similar structure; densely plumose; antennae of the female seven or eight jointed (pl.31, fig.7), the joints rounded or oval, the last one somewhat longer and cylindrical. In both sexes the basal joint disk-like. Palpi four-jointed. Thorax highly arched; produced more or less over the head, slightly flattened in front of the scutellum. Abdomen like that of most Chironomids; rather long and slender in the male; shorter and stouter in the female. Legs long and rather stouter than in Chironomus, fore metatarsus equal to or shorter than the tibia; the fourth tarsal joint, of most species at least, short, obcordate. Wings bare, venation as shown on pl.30, fig.13, resembling Tanypus in having the M-Cu crossvein; the subcosta slender, but distinct, R_1 and R_{4+5} ending in the costa; between these is the slender and delicate R_{2+3}; the media is simple; the R-M crossvein oblique; the M-Cu crossvein erect; the cell M is present; the cubitus forks a little before the M-Cu crossvein; the humeral crossvein is present. Genitalia as shown on pl.32, figs. 5 and 14.

Several species have been recorded from Europe and North America. Haliday in Walker's Ins. Brit. III (1856) has recorded species the males of which are said to have bare or short-haired antennae.

KEY TO SPECIES OF DIAMESA

Larvae

a Mouth parts as shown on pl.20, fig.9.....1. waltlii
aa Mouth parts as shown on pl.36, figs. 18 to 25; the dorsal surface of the abdominal segments marked with transverse fasciae (European species).....3. culicoides

Pupae

a Anal end with six slender filaments.....1. waltlii
aa Anal end with eight filaments.....3. culicoides

Imagines

a Halteres pale yellow; thoracic stripes black; length 4.5 to 5 mm. (United States, Europe, Greenland).....1. waltlii
aa Halteres white; thoracic stripes cinereous black; length 2.75 to 4.25 mm. (Greenland).....2. chorea

I cannot separate aberrata Lundbeck (1898) from waltlii.

1. Diamesa waltlii Meigen

1838 Diamesa Meigen. Syst. Beschr. 7:13, 1
1856 Chironomus Halid. in Walk. Ins. Brit. Dipt. 3:194
1864 Diamesa Schiner. Fauna Austr. 2:615
1898 Diamesa aberrata Lundbeck. Vidensk. Meddel. 289, 77

Larva. (Pl.20, fig.9) The larvae were taken in company with the larvae of Thalassomyia fusca among the algae on the surface of rocks over which the water flows rapidly. In color it is pale green, in general appearance and even in many details of structure it greatly resembles Thalassomyia fusca. The dorsal selerite of the head is elongated, shield-shape, with two pairs of marginal setae; on the lateral selerite there is one seta near the base of the mandible just above the lateral line, one pair below this one and a little cephalad; another pair about one quarter of the length of the head caudad of these but lying as far below the lateral line as the first is above. Directly caudad of the first, but midway between the front and hind margin of the head, is another; close to the dorsal suture, one quarter the length of the head cephalad of the caudal margin is still another; and finally there is a single one on each side at the base of the labium.

The mouth parts are as shown in the figure. The epipharynx is shown with its parts extended. In the figure given by the writer in Bul. 68. N. Y. State Museum (1903) these parts are shown folded down. The lateral arms (la) are each expanded apically into a handlike process with 7 or 8 fingers. The mandibles each have 5 blunt teeth, a fringe of coarse-branched hairs projecting mesad, and two stout setae on the dorsal surface near

the base. The labium (l) has about 19 blunt teeth; the antennae are of moderate length, bare, and with three terminal appendages. The entire body appears to be devoid of hairs. The thoracic and anal feet are of the usual Chironomus type. The dorsal tuft of the anal segment is present; blood gills of the eleventh segment absent.

Pupa. The pupa is fuscous in color, with a slightly greenish tinge. Thoracic respiratory organs apparently wanting. On the dorsal posterior margins of each of the abdominal segments, excepting the first and last, there are 10 to 12 short, stout caudad projecting teeth, the two or three lying nearest the lateral margin being smaller than those near the median line; and on the ventral surface of the segments, excepting the first, second and last, there are six or eight stout teeth projecting cephalad. At the anal end there are three pairs of short hollow filaments which may have a respiratory function. The length of pupal life is about two days.

This pupa greatly resembles that of D. culicoides as described by Heeger (1853) excepting that there are eight abdominal filaments in the latter while there are but six in the former.

Described from specimens taken in Cascadilla creek, Ithaca, N. Y. An empty pupal skin from Las Vegas, New Mexico, from Professor Cockerell does not differ from the one described above.

Male. Black; head black, including eyes, mouth parts and antennae, the latter densely covered with long, dark brown hair. Its first joint enlarged, disk-like, the second twice as long as broad, the following 11 a little shorter than broad, the 14th longer than all the rest taken together. The palpi are somewhat shorter than the antennae, four-jointed (besides a small basal piece), the first joint shorter, the fourth longer than the other two. Dorsum of the thorax black, subshining, with a faint cinereous bloom covering the surface, excepting the three slightly raised longitudinal stripes, which are deep black, and between which are arranged some scattered black setae; scutellum dark brown, with black setae; metanotum and pleura black, the latter with a gray bloom; abdomen black, longer than the wings in fresh specimens, covered with fine brown hairs, posterior margins of the segments narrowly cinereous. Genitalia conspicuous and rather complex (pl.32, fig.14); the apical joint of the appendages triangular in outline with a sharp point; the basal joint with a pointed process attached near its base on the inner side, mesad of which are two smaller pointed projections. The dorsal keel is nearly straight and spike-like. Legs uniformly fuscous, all the fourth tarsal joints shorter than the fifth, tarsal

claws simple. Wings broad, and nearly as long as the abdomen in fresh specimens; usually longer than the abdomen in dried specimens; cinereous in color, the anterior veins conspicuous, brownish or black; media and cubitus pale, posterior margin very delicately ciliate. Halteres usually pale, in an occasional specimen brownish, the knob triangular in outline. Length 3.5 to 5 mm. (pl.30, fig.13).

Female. Cinereous black, front and epistome cinereous, eyes but slightly excavated at base of antennae; palpi and antennae fuscous, the latter with 8 joints counting the disk-like basal joint, short-haired (pl.P, fig.7); scutellum hemispherical, dark brown, with black setae; abdomen fuscous with short brown hairs, posterior margins to the segments darker except on the extreme edge, which is pale yellow; genitalia small, brown and leaf-like; legs fuscous; claws simple; wings broad, and longer than the abdomen; anterior veins black; media and cubitus pale; length 3.5 to 5 mm. In other respects like the male. Described from bred and captured specimens. New York, Idaho, Washington State, Greenland.

Fitch's Chironomus nivoriundus, which I formerly considered a synonym of Diamesa waltlii Meig., I now regard as distinct.

According to Lundbeck (1898), D. waltlii does not possess cilia on the posterior margin of the wing, he quoting Meigen as authority for this statement; the European specimens, however, which I have do possess these cilia, as do also my American specimens. The cilia are quite short and rather difficult to see with a hand lens. D. aberrata Lundbeck (1898, p.290), according to its author, differs primarily from D. waltlii in possessing cilia on the posterior margin of the wing; but since waltlii does have the cilia, this distinction fails, and the two names must be regarded as synonymous. In the description of aberrata the scutellum and legs are said to be pale brown, while in waltlii, as described above, they are dark brown or fuscous. These differences are at most only varietal in character; and furthermore, in immature specimens these parts are usually somewhat paler than in mature specimens.

2. Diamesa chorea Lundbeck

1898 Diamesa Lundbeck. Vidensk. Meddel. 291

Greatly resembling D. aberrata Lundb.; its smaller size, obscure coloring, white halteres and more slender legs will distinguish it.

Male. Thorax cinereous, with three cinereous black stripes, the two laterals anteriorly abbreviated, the interval between sparsely hairy, scutellum cinereous brown, pilose, metathorax cinereous-black, the pleura gray, the pectus cinereous-black. Abdomen slender, cinereous-black with yellow hairs, the venter paler, the anal segments wide. Antennae brown, 14-jointed, plumose. Legs more or less dull brown, slender, setose. Halteres white. Wings slightly tinted, nearly hyaline, the margin short ciliate, the venation like that of D. aberrata. The fourth tarsal joints shorter, or at least not longer than the fifth; the fore metatarsus is somewhat shorter than the tibia.

Female. Antennae 8-jointed, short, the last joint elongate, fusiform, the abdomen shorter and stouter than that of the male; differs from the female of D. aberrata in its smaller size, shorter antennae, and wholly cinereous abdomen. Length of male and female 2.75 to 4.25 mm. Greenland. Translation.

3. Diamesa culicoides Heeger

1853 Sitzb. K. K. Acad. Wiss. Wien. 10:7

The larva, pupa and adult of this European species were described by Heeger (1853). Heeger's figures are reproduced on pl.36, fig. 15 to 25.

According to this author 80 to 100 eggs are laid by the female in groups of 10 or 12 upon stones or other objects along banks of the brook where they may be washed by the water from time to time. The eggs are described as being yellowish-white, nearly cylindrical, slightly smaller at one end, scarcely .25 mm. in length and nearly one-half as wide. The larvae emerge in about 8 or 10 days. They are white in the beginning; later the dorsal surface becomes brownish. When full grown about 12 mm. in length. The eyes are subtriangular, small, flat and black; the labrum is rounded, brownish-yellow, chitinous, scarcely one-sixth as broad as the head, one-half as long as broad, with four rounded teeth. The lower lip is one-half as broad but twice as long as the labrum, pale yellowish, truncated anteriorly, with the anterior margin densely hairy; the palpi are attached basally to this, and have the same structure as the lower lip. The labium is dark brown, is one-fourth as broad as the head, with a semicircular anterior margin, this margin provided with six very short rounded teeth on each side, and in the middle with a broadly truncated one (fig.19); the mandible (fig.18) is subcordate, one-fourth as long as the head, with five short rounded teeth, proximad of which there is a long row of yellowish brown, movable setae. The larva spins a thin, tube-like dwelling from which the head

claws simple. Wings broad, and nearly as long as the abdomen in fresh specimens; usually longer than the abdomen in dried specimens; cinereous in color, the anterior veins conspicuous, brownish or black; media and cubitus pale, posterior margin very delicately ciliate. Halteres usually pale, in an occasional specimen brownish, the knob triangular in outline. Length 3.5 to 5 mm. (pl.30, fig.13).

Female. Cinereous black, front and epistome cinereous, eyes but slightly excavated at base of antennae; palpi and antennae fuscous, the latter with 8 joints counting the disk-like basal joint, short-haired (pl.P, fig.7); scutellum hemispherical, dark brown, with black setae; abdomen fuscous with short brown hairs, posterior margins to the segments darker except on the extreme edge, which is pale yellow; genitalia small, brown and leaf-like; legs fuscous; claws simple; wings broad, and longer than the abdomen; anterior veins black; media and cubitus pale; length 3.5 to 5 mm. In other respects like the male. Described from bred and captured specimens. New York, Idaho, Washington State, Greenland.

Fitch's Chironomus nivoriundus, which I formerly considered a synonym of Diamesa waltlii Meig., I now regard as distinct.

According to Lundbeck (1898), D. waltlii does not possess cilia on the posterior margin of the wing, he quoting Meigen as authority for this statement; the European specimens, however, which I have do possess these cilia, as do also my American specimens. The cilia are quite short and rather difficult to see with a hand lens. D. aberrata Lundbeck (1898, p.290), according to its author, differs primarily from D. waltlii in possessing cilia on the posterior margin of the wing; but since waltlii does have the cilia, this distinction fails, and the two names must be regarded as synonymous. In the description of aberrata the scutellum and legs are said to be pale brown, while in waltlii, as described above, they are dark brown or fuscous. These differences are at most only varietal in character; and furthermore, in immature specimens these parts are usually somewhat paler than in mature specimens.

2. Diamesa chorea Lundbeck

1898 Diamesa Lundbeck. Vidensk. Meddel. 291

Greatly resembling D. aberrata Lundb.; its smaller size, obscure coloring, white halteres and more slender legs will distinguish it.

Male. Thorax cinereous, with three cinereous black stripes, the two laterals anteriorly abbreviated, the interval between sparsely hairy, scutellum cinereous brown, pilose, metathorax cinereous-black, the pleura gray, the pectus cinereous-black. Abdomen slender, cinereous-black with yellow hairs, the venter paler, the anal segments wide. Antennae brown, 14-jointed, plumose. Legs more or less dull brown, slender, setose. Halteres white. Wings slightly tinted, nearly hyaline, the margin short ciliate, the venation like that of D. aberrata. The fourth tarsal joints shorter, or at least not longer than the fifth; the fore metatarsus is somewhat shorter than the tibia.

Female. Antennae 8-jointed, short, the last joint elongate, fusiform, the abdomen shorter and stouter than that of the male; differs from the female of D. aberrata in its smaller size, shorter antennae, and wholly cinereous abdomen. Length of male and female 2.75 to 4.25 mm. Greenland. Translation.

3. Diamesa culicoides Heeger

1853 Sitzb. K. K. Acad. Wiss. Wien. 10:7

The larva, pupa and adult of this European species were described by Heeger (1853). Heeger's figures are reproduced on pl.36, fig. 15 to 25.

According to this author 80 to 100 eggs are laid by the female in groups of 10 or 12 upon stones or other objects along banks of the brook where they may be washed by the water from time to time. The eggs are described as being yellowish-white, nearly cylindrical, slightly smaller at one end, scarcely .25 mm. in length and nearly one-half as wide. The larvae emerge in about 8 or 10 days. They are white in the beginning; later the dorsal surface becomes brownish. When full grown about 12 mm. in length. The eyes are subtriangular, small, flat and black; the labrum is rounded, brownish-yellow, chitinous, scarcely one-sixth as broad as the head, one-half as long as broad, with four rounded teeth. The lower lip is one-half as broad but twice as long as the labrum, pale yellowish, truncated anteriorly, with the anterior margin densely hairy; the palpi are attached basally to this, and have the same structure as the lower lip. The labium is dark brown, is one-fourth as broad as the head, with a semicircular anterior margin, this margin provided with six very short rounded teeth on each side, and in the middle with a broadly truncated one (fig.19); the mandible (fig.18) is subcordate, one-fourth as long as the head, with five short rounded teeth, proximad of which there is a long row of yellowish brown, movable setae. The larva spins a thin, tube-like dwelling from which the head

mass is boiled or treated with hardening agents. The interior of the cylinder is traversed by interwoven cords. As many as 19 spires have been counted in one egg mass and since each spire commonly contains about 45 eggs, the total may amount to 850 or even more."

In an undetermined North American species observed by the writer, the egg mass is in the form of a clump enveloped in gelatine, which is moored by means of a cord to a stone or a weed along the bank of a pool. The eggs within this clump have no definite arrangement but lie at random (fig.10). Another North American species lays a string in which the eggs are arranged as shown in fig.15, and still another as shown in fig.12.

Larva. All the larvae of the members of this group are rather slender, have a rather short head, and possess thoracic and anal prolegs (pl.16). In size the mature larvae vary from 4 or 5 mm. to upwards of 25 mm. Many of the largest species are blood red in color, while the smaller ones are yellow, light or dark green, brownish, or pink. The head is small, brownish in color, heavily chitinized, and a little longer than wide. The sclerites of the head consist of a dorsal, ventral, and two lateral plates, besides a number of smaller ones. The dorsal sclerite is elongate shield-shaped, often with a few setae. Attached to the front margin of this plate is the labrum, which hangs flap-like in front of the mouth and may be bent backward; and on the under surface are several pairs of setae, usually pectinate. Attached to the ventral surface of the labrum is the epipharynx. This is a rather complex structure; it is attached at its anterior margin, its free margin projects ventrad and caudad. Its form varies in the different genera. The lateral plates bear two pairs of rudimentary eyes (pigment spots) as well as the antennae and the jaws. The antennae (pl.16, fig.5, and pl.22, fig.1a) are situated on the anterior end of the lateral plates; they consist of a comparatively long basal joint and several shorter terminal ones. The mandibles (pl.22, fig.1, md) situated ventrad of the antennae are stout and have a four or five toothed margin. They are articulated in such a manner that they move in an oblique plane, striking the labium (pl.16, fig.5). The labium is attached or rather is coalescent with the front margin of the ventral sclerite of the head, the suture separating

the sclerite from the lateral ones only faintly marked. Miall and Hammond (1900) consider the ventral piece as a portion of the lateral sclerite. The margin of the labium is toothed (pl.22, fig.1 l) ; the size and arrangement of the teeth vary in the different species. Near the base and ventrad of the mandibles are the maxillae (fig.1 mx) consisting of fleshy processes, with a short cephalad projecting palpus (fig.1 p), and some setae and papillae. On each side of the labium is a striated and flexible fan-shaped flap which helps to close in the mouth. On the floor of the mouth cavity, lying close to the labium, is the hypopharynx (fig.1 hy), with various setae and papillae. The prothoracic pair of feet is furnished with a large number of slender, curved hairs, sometimes pectinate, the two feet very close together so that they appear almost as one (pl.21, fig.8). The first three segments of the body in specimens which are ready to transform are enlarged and represent the thorax; the intermediate segments of the abdomen are subequal in length and usually have a few setae. On the ventral surface of the eleventh segment of those species which are blood red in color there are two pairs of long blood gills pl.16) ; on the caudal end of the dorsal aspect of the last segment are two small papillae each surmounted by a tuft of a few long hairs; ventrad of these there is a bunch of four short blood gills. The anal feet are about as long as the eleventh segment, each one with a crown of from 10 to 20 bifid claws (pl.21, fig.9).

Pupa. The pupa is somewhat elongate, the thorax enlarged, and the abdomen 8-segmented, not counting the anal appendages (pl.16 and pl.23, fig.9). Upon the cephalic end of the thorax are the respiratory organs, which may consist of a pair of much branched filaments, or a pair of tubes or knobs, or may be entirely wanting. On the abdomen there are frequently a few lateral filaments, and at the caudal end of the lateral fins of the eighth segment there is often a chitinized comb or spur (pl.22, figs. 8 and 26) with a variable number of teeth depending upon the species. Usually the dorsum of each abdominal segment is marked by a large number of short and very minute setae arranged in some constant pattern for a given species (pl.22, figs. 3, 12, 13, 14, 15). The ninth or anal segment may be provided with a fringe of matted hairs, forming a paddle, or may have only a few characteristic setae.

Imago. Rather large to very small species, characterized by the structure of their antennae and the wing venation. Head small, somewhat compressed laterally; epistome somewhat prominent, and usually hairy; proboscis short; palpi incurved, four jointed, the last joint somewhat elongated. Antennae of the male 14-jointed, the first joint large, disk-like; the second cylindrical, the following ones rounded and closely crowded, the last joint very long, often as long as the others taken together; all long plumose; that of the female 7-jointed, the first disk-like, the second cylindrical, the following egg or pear-shaped, short verticillate, the last one cylindrical or ellipsoidal, short-haired; eyes reniform, ocelli are wanting. Mesothorax highly arched, projecting over the head, without transverse suture, with a depressed area in front of the scutellum; the pectus deeply arched, scutellum small; metanotum well developed. Abdomen long and narrow, compressed cylindrical, 8-jointed; hypopygium tong-like. Legs very slender and long, especially the anterior pair, which are widely separated from the following pairs; coxae elongated, the tibiae sometimes very short, and the metatarsi often much elongated, the vesture woolly and short, sometimes fringe-like; claws and pulvilli present. Wings long and slender, hairy or bare, folded over the abdomen when at rest; in the male often shorter than the abdomen. Venation as in the figures on pls. 28, 29, 30, and 31; anal angle present; the halteres free.

Van der Wulp (1874) divided this group into a number of genera, using as characters for the subdivisions the relative length of the fore tibia to the metatarsus, the condition of the wing, i. e., whether hairy or bare, and the course of the cubitus. Descriptions of these genera are given on subsequent pages.

Genus 37. Thalassomyia Schiner

Verh. zool. bot. Gesell. 6:218. 1856

This genus was erected by Schiner (loc. cit.) to contain the species T. frauenfeldi, of which only the female was known. More recently Dr Tömösvary (1884) described another species T. congregata, and in 1903 the writer described the male and female of a third, T. obscura. Coquillett (1902) described a fly which he called Orthocladius

platypus from Arizona and which probably also belongs to this genus, making four species thus far known.

The eggs of T. congregata are laid in strings of gelatine, in which the elongate oval eggs are placed. The larvae of the two species of which they are known live in rapidly flowing water. Here the larva spins upon the surface of the rock a cocoon so loose, transparent, and open that it is not hidden by it, though it prevents the larva from being washed away. The larva greatly resembles Diamesa from which the one American species which is known in the larval state can be distinguished by the form of its labium. The larva is pale green in color with a dark brown head, and without blood-gills on the ventral surface of the eleventh segment. The pupa is apparently without thoracic respiratory organs; and the dorsal surface of the abdomen is provided with numerous setae.

Imago. The genus resembles in many respects both Orthocladius and Diamesa; from the former it may be distinguished by its having the fourth tarsal joint of all the feet in both sexes obcordate and shorter than the fifth; from the latter genus in having no M-Cu. crossvein (pl.30, fig.12).

Head small, broad, eyes elongate, somewhat emarginate, ocelli wanting. Antennae 14-jointed in the male, long, densely haired, the 14th joint like that of Chironomus; antennae of female 7-jointed, sparsely short-haired, joints rounded, basal joint of both male and female flattened, disk-like. Palpi 4-jointed. Thorax arched. Abdomen of the male moderately slender, of the female shorter and stouter. Legs moderately slender, fore metatarsus shorter than the tibia, the fourth tarsal joint of all the feet in both sexes shorter than the fifth and obcordate. Wings bare, venation resembling that of Orthocladius, the M-Cu. crossvein wanting. The forking of the cubitus may be either proximad or distad of the R-M crossvein.

KEY TO SPECIES OF THALASSOMYIA

Imagines

a Dorsum of thorax blackish with indications of three stripes; humeral spots, scutellum, and pleura yellowish or brownish; abdomen dull black, first two segments greenish; length 3 to 5 mm. (New York)
1. obscura

aa Thorax black, humeral spot yellow; length 2.5 mm. (Flagstaff, Arizona)
2. platypus

1. Thalassomyia obscura Johannsen

1903 Thalassomyia Johannsen. N. Y. State Museum bul. 68. 437

Larva. The eggs were not found. The larva is 8 to 10 mm. in length when full grown, pale or yellowish green in color, its head is dark brown and heavily chitinized. The head is somewhat longer than wide, the dorsal suture well marked. Two setae are placed immediately in front of the transverse suture, and at the apical end of the labrum are two more. The lateral arms of the ventral surface of the labrum are rather short and stout, and somewhat pointed. The anterior ventral margin of the labrum is provided with short fleshy filaments instead of setae as is usually the case in Chironomus. The antennae are small, the basal joints about four times as long as wide, each with two terminal pieces, one of which is four-jointed, the other simple. The mandible is about twice as long as broad, with five blunt teeth; articulated at the base is a long slender process with four terminal spines. The maxillae are short protuberences, covered with pointed projections, with a very short palpus with its terminal papillae, and two stout setae projecting ventrad. The hypopharynx is tonguelike, with two long basal pieces. Its apex and its dorsal surface are covered with pointed papillae; ventrally there is an open arched rib. At the cephalic end of the ventral sclerite, and coalescent with it, is the labium, with 11 blunt marginal teeth, the middle one wide and broadly truncated. On the prothoracic segment are the two prolegs, each with about 30 long curved spines, and a number of short and very small spines on the ventral surface. At the base is a single slender seta, on each side a little dorsad of the lateral line are two more, and caudad of these and below the lateral line a group of three. The eleventh segment is without blood gills; the twelfth with two comparatively short legs, each with a crown of 8 to 10 bifid claws; on the dorsal surface are two small protuberences upon each of which is a tuft of five or six long setae. Between the legs and projecting caudad are four short blood gills.

Pupa. The pupa is about 4.5 mm. long, with the colors of the adult. It is much shorter in comparison to its breadth than is Chironomus. The wings extend to a little beyond the posterior margin of the second abdominal segment. Eight segments are present besides the short anal segment. On the dorsum of each segment, toward the caudal margin, is a transverse band of stout black bristles. Each band is composed of five or six rows. The most caudad of these rows contain the longest bristles. The anal segment is composed of two small lobes, each with a single apical bristle. After two to four days of pupal life it transforms into the imago. (See pl.50 in N. Y. State Mus. Bul. 68.)

Imago, male. Front and epistome yellow, palpi fuscous, shorter than the antennae, its first joint about 1.5 times as long as broad, the second twice, the third three times and the fourth four times as long as the first. Antennae fuscous, 14-jointed, the first disk-like, the second longer than broad, the third to the thirteenth about as long as broad, the fourteenth longer than all the others taken together; all furnished with long brown hairs except the apical one-fourth of the fourteenth. Dorsum of the thorax blackish; yellow on the humeri and pleura, covered with a white bloom, most conspicuous on the humeri. The dorsum of the thorax has a dirty yellow ground color, but the three black longitudinal stripes are so wide that only a little of the ground color shows, excepting on the humeri and the two very narrow faint longitudinal stripes separating the three wide, black ones; the scutellum is chestnut; metathorax black; pectus brown; abdomen dull black, the dorsum of the first two segments greenish; the extreme edge of each segment, paler fuscous; the venter greenish, darker, almost black on the more posterior segments. The green is sharply separated from the dorsal color on a lateral line. In dried specimens this green color becomes dusky; legs almost black, the coxae and the bases of the femora yellowish, fore tarsi only pubescent, not hairy; fore metatarsus about three fourths as long as the tibia; tarsal claws simple; wings hyaline, hairless, the anterior veins yellowish, the rest hyaline, venation as in fig.12, pl.30; anterior and posterior margins delicately ciliate; genitalia inconspicuous. Halteres white. Length 3 to 5 mm.

Female. Antennae seven-jointed, black, with short hairs. Thorax with black stripes a little narrower than in the male, hence the yellow stripes separating them and those on the humeri more conspicuous. Pectus, scutellum, and a little space in front of the latter brown; the pectus in dried specimens sometimes nearly black; pleura yellow, metanotum black; abdomen as with the male, but the venter is paler; legs black, coxae and bases of femora yellow; tarsal claws simple; wings hyaline, anterior margin and tip a little dusky; anterior veins yellow; wing margins delicately ciliate; venation as with the male; halteres white. Length 3 to 5 mm. Many captured and bred specimens. Ithaca, N. Y.

2. Thalassomyia platypus Coquillett

1902 Orthocladius Coquillett. Proc. U. S. Nat. Museum. 25:93

Black, a large dull yellowish humeral spot, halteres, trochanters, and extreme bases of femora yellow; hairs of antennae dark gray, thorax opaque, grayish pruinose; tarsi only pubescent, the fourth joint dilated, emarginate at the apex, noticeably shorter than the fifth, first joint of front tarsi three fourths as long as the tibiae;

wings hyaline, small crossveins not darker than the adjacent veins, not clouded with brown, third vein beyond its middle slightly bowing toward the costa; length 2.5 mm. Male. Flagstaff, Arizona. New Jersey (Johnson).

Thalassomyia frauenfeldi Schiner

Theobald in "An Account of British Flies," p.202, reproduces a note of Mr Swainson, which reads in part as follows:

" . . . I found this larva several times on Obelia zoophytes growing at the end of St Anne's pier. Next I found it on some Coryne from the Mumbles (Swansea) and more recently I dredged it from fifteen fathoms off Spanish Head (Isle of Man) adhering to seaweed. Professor Miall, of Leeds, to whom I sent specimens, thought it would ultimately turn out that Johnston's Compontia was Schiner's Thalassomyia frauenfeldi. This seems very possible, as the descriptions are very similar. . ."

The figure given by Theobald (1892) is reproduced on pl.34, fig.1.

Genus 38. Chironomus Meigen

Illiger's Magaz. 2:260. 1803. (Chironomus, part)

Larva. The larvae of this genus differ from those of the other genera of the group Chironomus primarily in the form of the mouth parts, and are known as bloodworms; some species, however, have pale larvae. The antennae are short, with the first joint nearly twice as long as the remaining four taken together. Set on the end of the first joint, there is, besides the second joint an unsegmented appendage. On the under surface of the labrum are several pairs of setae and sometimes a pair of fan-shaped organs, perhaps sense-organs. The epipharynx is well developed, and on each side of it is a long chitinized, sickle-shaped process, which are called the lateral arms in the following descriptions (pl.22, fig.10 la, and pl.23, fig.10 lr). At the anterior margin of the epipharynx is a minute comb with caudad projecting teeth (pl.23, fig. 10 c); caudad of these is a horseshoe-shaped piece with the open end projecting cephalad (fig.10). Within this arch are several curved pectinate setae, which may be erected, though they are usually folded down as shown in the figures. The maxilla has, besides the rather prominent palpus, some cephalad projecting filaments on the outer lateral margin and a number of setae, papillae and filaments on the inner margin (pl.22, fig.1 mx). The eleventh abdominal segment has usually though not always two pairs of blood gills besides those on the twelfth segment.

Pupa. The pupa usually remains within the tube constructed by the larva, but is capable of swimming freely like a frog larva. It is provided with a pair of much branched thoracic filaments, and its caudal segment is fringed with long matted hairs or filaments forming a paddle (pl.23, fig.9 f).

Imago. The genus Chironomus as restricted by Van der Wulp (1874 and 1877, p.245) is defined by him in the latter work as follows: Face usually hairy, lengthened downward snout-like; proboscis short, palpi bent, 4-jointed, the last joint elongated. Antennae filiform, in the male 14-jointed, the first joint short, disk-like, the second cylindrical, the following rounded, closely sessile, the end joint very long and slender, all long and densely plumose; toward the tip the hairs become gradually shorter; in the female the antennae are much shorter, 7-jointed; the first joint short, disk-like, the second cylindrical, the following four oval, sparsely haired, the last joint somewhat elongate. The eyes on their mesal margin deeply emarginate, ocelli wanting: Thorax highly arched, more or less projecting over the head, flattened in front of the scutellum, pectus very prominent, scutellum small; metanotum well-developed; the markings of the thorax, if not unicolored, consist of three, usually wide longitudinal stripes, of which the median is posteriorly and the two laterals anteriorly abbreviated; sometimes the median stripe is divided longitudinally by a fine line, which continues to the scutellum. Abdomen cylindrical, in the male sometimes flattened, the last or anal segment distinctly separated from the preceding, longer than broad, the genitalia projecting tong-like, the claspers filiform or leaf-like. Legs long and slender, particularly the fore pair, of which the tibiae are frequently very short, while the fore metatarsus is always longer than its tibia; the fore tarsi of the male are sometimes peculiarly haired; the tarsal claws and pulvilli upon all the feet are small but distinct. The wings are bare, in the male often shorter than the abdomen, the anal angle always present, sometimes strongly projecting; subcostal vein delicate but distinct, as is also R_1 which enters the costa beyond the middle of the wing; R_{4+5} emerges from the small crossvein, at its extremity usually slightly curved downward, entering the margin not far from the apex of the wing; the media is unbranched and joins

the wing margin at or a little below the apex; the cubitus is forked; the R-M crossvein is at about the mid length of the wing; the humeral crossvein is sometimes wanting.

To the above description I may add that R_{2+3} is present though usually quite delicate. The male genitalia consist of a dorsal downward curved keel, a pair of elongate lateral lobes, a pair of inferior and a pair of superior lobes (pl.32, fig. 7 to 13).

KEY TO SPECIES OF CHIRONOMUS

Larvae

The tooth on the middle line of a labium having an odd number of teeth will be called the middle or median tooth, the first tooth laterad of this will be called the first lateral; the second, the second lateral, and so on. When there is an even number of teeth, the first one laterad of the median line will be called the first lateral; the second, the second lateral, etc.

a Labium with an odd number of teeth (i. e. center line bisects the middle tooth)
  b Middle tooth broadly truncate, pl.21, fig.18; pl.23, fig.15
    c First lateral tooth smaller than the second, second truncate, pl.23, fig.15.....59. ?plumosus
    cc First lateral about same size as the third.....16. flavicingula
  bb Middle tooth rounded
    c Middle tooth trilobed
      d Teeth short, pl.23, fig.8.....60. decorus n. sp.
      dd Teeth long, pl.23, fig.13.....79. Chir. sp.
    cc Middle tooth simple
      d First and second lateral teeth rather closely united, pl.21, fig.1
        e Teeth as shown on pl.21, fig.1.....25. tenellus
        ee First and second laterals more distinctly separated than shown on this plate.....48. dux n. sp.
      dd First and second laterals as distinctly separated as the other teeth
        e Middle tooth shorter than the first laterals; blood red larva 80. Chir. sp.
        ee Middle tooth as long or longer than the laterals
          f Second and third laterals longer than the first laterals and closely united, pl.37, fig.27.....63a. tentans
          ff Not as above
            g Second laterals longer than the first and third
              h As shown on pl.23, fig.1.....60a. dorsalis
              hh As shown on pl.37, fig.25.....63. prasinus
            gg Teeth gradually becoming smaller from the median line towards the lateral margin
              h Teeth almost uniform in size, pl.22, fig.7..81. Chir. sp.
              hh Middle tooth distinctly larger
                i Middle tooth semicircular, pl.23, fig.3..52. lobiferus
                ii Middle tooth hyperbolic, pl.22, fig.11..43. modestus

aa Labium with an even number of teeth
b The two middle teeth much paler in color than the others, pl.22, fig.22
82. Chir. sp.
bb The teeth uniformly dark
c Middle pair (first laterals) shorter than the second laterals, pl.22, fig.24 .....44. fulviventris n. sp.
cc Middle pair as long or longer than the laterals
d Middle pair (first laterals) noticeably longer than the second laterals
e Third laterals longer than the second, pl.22, fig.1
41. flavus n. sp.
ee Third laterals about same size as the second; bloodworms, pl.21, fig.6 .....32. nigricans n. sp.
dd The middle pair about the same size as the second laterals; bloodworms, pl.23, fig.6, No. 83; and pl.22, fig.21, No. 84

Pupae

aa Lateral fin of the eighth abdominal segment terminates in a spur, which may be simple or toothed
b Spur simple, without teeth
c Abdominal segments each with a few long setae, pl.22, fig.20
40. ?fulvus n. sp.
cc Abdominal segments each with a pattern of very minute spines
d Spurs of eighth segment stout, pl.23, fig.12..60. decorus n. sp.
dd Spurs slender and seta-like
e See pl.22, figs. 8 and 12.....43. modestus
ee See pl.21, figs. 2 and 3.....25. tenellus
bb Spur, if present, with teeth
c Spur wanting, pl.22, fig.14.....43b. Var. of modestus
cc Spur present
d Large species over 15 mm. in length, pl.23, fig.14
59. ?plumosus
dd Smaller species
e Each abdominal segment with a fuscous transverse band near the anterior margin, produced at the ends into lateral longitudinal vittae, pl.22, figs. 3 and 4.....41. flavus n. sp.
ee Not so marked. Species from Saranac Inn, pl.22, figs. 13 and 17, and fig.18 (perhaps Tanytarsus sp.)
aa Lateral fin with a comb of three or more teeth
b Comb with three distinct teeth, pl.22, fig.26
44. fulviventris n. sp.
bb Comb not as shown in this figure
c The median abdominal segments each marked with three transverse bands; the first and third narrow, the middle one wide with a number of hyaline spots, pl.21, figs. 16 and 17
16. flavicingula
cc Abdominal segments not so marked
d In nearly mature pupae may be seen the lobes on the dorsum of each abdominal segment of the enclosed imago, pl.23, figs. 4 and 5.....52. lobiferus

dd Not as above

e Dorsum of each median abdominal segment marked with spines of several sizes; those in a transverse row near the anterior and the posterior margins are most prominent
32. nigricans n. sp.

ee The spines most conspicuous in two oblong patches beyond the middle of each segment

f The teeth of the comb of the eighth segment projects caudad, pl.22, figs. 15 and 16.....43a. Var. a of modestus

ff Teeth of the comb of the eighth segment project laterad. Markings on the abdomen resembles pl.22, fig.15, but covers more area on the anterior segments.....48. dux n. sp.

Weyenbergh (1874) gives a few notes on the larvae of several species, among others, C. nubeculosus, diversus, riparius, annularis, chloris, virescens, and tentans. Of tentans only is a description given. Doctor Dyar (1902) gives descriptions of larva and pupa of C. anonymus Will. (No. 55). This description is in part reproduced on a subsequent page.

Imagines

Most of Say's and Wiedemann's species have been recognized and have been placed in the following key. Of Walker's species only one or two have been recognized and for this reason a separate key is given upon a subsequent page for them:

a Wings with spots or cross bands

b Dorsum of thorax polished black (humeri may be yellow)

c Humeral region of thorax tinged with yellow, wing with only a faint cloud .....1. brachialis

cc Thorax entirely black (var. of above?).....2. atrimanus

bb Dorsum of thorax not polished black

c Wings with spots

d Each wing with about eleven spots; brownish or greyish species; 3 mm. in length (New Mexico).....3. varipennis

dd Wings not so marked

e Thorax pale yellow, wing with four spots; length 1.2 mm. Cuban species.....4. octopunctatus

ee Thorax brownish

f Wing with three dark spots; thorax indistinctly striped; abdomen dusky; length 2 to 2.5 mm.....5. scalaenus

ff Wing with five or six spots, or bars; abdomen of female with whitish posterior margins to the segments; length 2 mm. (St Vincent Island).....6. spilopterus

cc Wings with cross bars

d Brownish species; abdomen of female black with white posterior margins to the segments; length 2 mm. (St Vincent Island)
6. spilopterus

dd Yellowish or greenish species

e Legs pale; tibiae with black tips; thorax and abdomen yellow; length 4 mm. ..... 7. f a s c i p e n n i s

ee Some or all femora partly black; metanotum with brown vittae or spots; length about 4 mm.

f "Metanotum marked with a transverse pair of triangular brown spots" ..... 8. t a e n i a p e n n i s

ff "Metanotum marked with a pair of brown spots which approach each other posteriorly." (This may be a synonym of the t a e n i a p e n n i s above) .. 9. p u l c h r i p e n n i s

aa Wings unmarked, excepting sometimes with darkened crossvein

b Dorsum of thorax and abdomen black. The former may have indistinct stripes and the latter may have paler incisures

c Legs black or fuscous

d Thorax shining black

e Halteres white; wings white, immaculate; male; length 2.75 mm. ..... 10. b r u n n i p e s

ee Halteres with brown knob; wings hyaline, very slightly smoky, with anterior veins and crossvein brown; fore metatarsus nearly twice as long as its tibia; length 3.5 mm.

11. b r u n n e i p e n n i s n. sp.

dd Thorax grayish, with black stripes; abdomen black

e Abdomen uniformly dark brown or black; halteres white with end of knob brown ..... 12. c a l i g i n o s u s n. sp.

ee Abdomen with whitish incisures or margins

f Fore metatarsus ⅛ longer than its tibia; halteres dark in the male, paler in the female; anterior tarsi of the male with long hairs ..... 13. n i v e i p e n n i s

ff Fore metatarsus ¼ longer than its tibia

g Anterior tarsi of the male long-haired; abdominal segments with narrow white posterior margins; wings hyaline with black crossvein (Greenland) ..... 14. h y p e r b o r e u s

gg Anterior tarsi of the male short-haired; abdominal segments with cinereous margins; wings slightly cinereous

15. s t a e g e r i

cc Legs more or less pale

d Halteres with gray or black knobs

e Femur black with yellow apical ring; tibia black and yellow; wings with black crossvein ..... 16. f l a v i c i n g u l a

ee Legs not so marked

f Mesonotum and scutellum shining black

11. b r u n n e i p e u n i s n. sp.

ff Mesonotum pruinose, scutellum yellowish; length 2.3 mm.

17. h a l t e r a l i s

dd Halteres with pale knobs

e Basal joint or joints of abdomen yellow

f First and second abdominal segments yellow; male

18. n i t i d e l l u s

ff First segment only yellow ..... 19. f a l l a x n. sp.

ee Basal joints black

f Crossvein clouded with black or brown

g Fore metatarsus about 1½ times its tibia in length; anterior tarsi of both sexes very slender and without hairs or with but few hairs; legs pale.....20. riparius

gg Fore metatarsus less than 1¼ times its tibia in length; anterior tarsi of the male bearded

h The second fore tarsal joint shorter than the third; male fore tarsi long and densely bearded....21. barbipes

hh The second fore tarsal joint longer than the third; male fore tarsi long but thinly bearded....22. annularis

ff Crossvein not clouded

g Length about 7 mm.; black, abdomen black, in the male sometimes with yellow latteral spots; male fore tarsi delicately bearded; fore metatarsus about 1½ times the length of its tibia.....23. dispar.

gg Length less than 6 mm.

h Thorax shining black, not striped; abdomen black

i Legs blackish, fore metatarsi white; length 4 mm. 24. albimanus

ii Legs pale yellow; abdomen of female with paler base; length 3.5 mm.....25. tenellus

hh Thorax duller, with indications of black or grey stripes

i Abdomen either olive green, or black and white

j With dark olive green abdomen; legs ferruginous; length 4.5 mm.; male.....26. chloris

jj With white posterior margin on each abdominal segment; legs black and white; length 4 to 5 mm.

k Fore femora black, fore metatarsus less than 1.33 times as long as its tibia.....27. devinctus

kk Middle section of each femur, white; fore metatarsus about 1.66 times its tibia in length 28. californicus n. sp.

ii Abdomen black

j Thorax blackish with black stripes; legs wholly white, except sometimes middle section of fore femora is brownish (abdomen of male is white); female .....32. nigricans n. sp.

jj Thorax dark brown with broad yellowish median vitta on anterior half and a pair of gray vittae on posterior part; abdomen velvet-black, hairs yellow (District of Columbia).....29. palliatus

bb Thorax or abdomen or both with considerable green or yellow or gray

c Thorax entirely shining black, excepting sometimes the humerus, which may be yellow

d Abdomen yellow with brown bands.....1. brachialis

dd Abdomen bright green, paler when dry, posterior segments darker

e Halteres wholly pale.....30. pedellus

ee Halteres with black tip.....31. p e d e s t r i s
cc Thorax not shining black
d Legs dark brown; thorax yellow with three black stripes; female 10. b r u n n i p e s
dd Legs more or less yellow
e Thorax dark brown with three broad black stripes; abdomen nearly white, excepting sometimes the last three segments; incisures occasionally slightly fuscous
f Legs white, the middle section of each fore femur occasionally brownish; male.....32. n i g r i c a n s n. sp.
ff Legs white, apical one third or one half of each fore femur and basal one third or one half of each tibia black; middle and hind knees sometimes also darkened; last three abdominal segments blackish; male.....30. p e d e l l u s
ee Thorax not so marked when the abdomen is pale
f Abdomen fuscous, the anterior segments yellowish green 33. a b e r r a n s n. sp.
ff Abdomen not marked in this manner
g Abdomen nearly uniform in color
h Abdomen brown, olive green or black
i Abdomen dark olive green; legs ferruginous; fore femora dark; crossvein not clouded; female 26. c h l o r i s
ii Abdomen dark green, brown or black
j Thorax yellow unstriped; abdomen brown; legs yellow; length 3 to 4 mm. (St Vincent Island) 34. l u g u b r i s
jj Thorax brown or yellowish with stripes
k Legs wholly yellow; abdomen black with yellowish base; female.....25. t e n e l l u s
kk Legs partly brownish
l Thorax dark brown with broad yellow median vitta, and a pair of gray vittae on posterior part; abdomen velvet black; anterior femora brownish .....29. p a l l i a t u s
ll Thorax with black or brown stripes
m Halteres pale; female with dark greenish abdomen; fore metatarsus nearly twice as long as its tibia.....35. f u m i d u s n. sp.
mm Knob of halteres with a dark tip; abdomen fuscous .....12. c a l i g i n o s u s n. sp.
hh Abdomen pale, bright green or yellow; in dried specimens sometimes somewhat brownish; crossvein uncolored
i Species exceeding 6½ mm. in length
j Abdomen of female yellow; male with darker markings in front of incisures; pectus, metanotum and scutellum pale; dorsum yellow with three dark yellow stripes; length 6.5 to 7.5 mm...36. t e n d e n s

jj Thorax pale greenish, with a "fuscous longitudinal line on the anterior dilated line"...37. l i n e a t u s

ii Species less than 6 mm. in length

j Thorax reddish yellow, shining, with three dark brown stripes; metanotum brown, scutellum yellow; abdomen green (when dried sometimes brownish); legs yellow; tarsal articulations usually darkened; fore metatarsus but little longer than its tibia; length 5 to 6 mm.....38. a l b i p e n n i s

jj Not as above; thoracic stripes buff-colored

k Thorax and abdomen green, the former with a median black line, besides the usual buff-colored stripes; metanotum with a black spot; length 5 mm. .....39. t a e n i o n o t u s

kk Thorax without the black median line

l Species having the fore metatarsus more than $1\frac{2}{3}$ times as long as its tibia

m Yellow species (in dried specimens)

n Deep yellow species, usually 3 to 4.5 mm. in length; fore metatarsus about 1.75 times the length of its tibia; female
40. f u l v u s n. sp.

nn Pale yellow species with a striped thorax; abdomen having a greenish tinge in living specimen; length 2 to 2.5 mm.
41. f l a v u s n. sp.

mm Abdomen green and usually thorax also

n Fore tibia two thirds as long as its femora, fore metatarsus nearly twice as long as the tibia; length 3.5 to 4.5 mm.
42. b r e v i t i b i a l i s

nn Fore tibia more than two thirds as long as the femora

o Species 3.5 mm. or more in length

p Male genitalia with the lateral arms slender, and somewhat lanceolate; thorax with buff-colored stripes; its ground color greenish yellow or yellow in the male; green in the female
43. m o d e s t u s

pp Genitalia of male with the lateral arms much prolonged and clubbed at the end, pl.32, fig.9
43. Var. b. m o d e s t u s

oo Species 3 mm. or less in length
43. Var. a. m o d e s t u s

ll The fore metatarsus less than 1.4 times as long as its tibia

m Yellow or whitish species

n Deep yellow species; female with greenish tinged abdomen; male with brown abdominal fasciae; fore metatarsus about 1⅛ times as long as its tibia; length 4 to 5 mm. .....44. fulviventris n. sp.

nn Species with white or very slightly green-tinted abdomen; thorax testaceous; knees blackish, fore metatarsus about 1.25 times as long as its tibia; length 4 mm. (See also No. 54).....45. pallidus n. sp.

mm Green species

n Joints of the legs each with a moderately wide black apical band; fore femora and fore metatarsus of about equal length and each about 1.33 longer than the tibia 46. frequens n. sp.

nn Joints of legs without distinct black apices

o Fore femora and tibiae of equal length; fore metatarsus about 1.33 times as long as the tibia; fore tarsi of male hairy 47. viridis

oo Fore femora noticeably longer than the tibiae; fore tarsi of male bare 48. dux n. sp.

gg Abdomen bicolored, each segment with crossbands or marked incisures which may be light or dark, yellowish or brownish

h Thorax with wide black stripes

i Species over 7 mm. in length; thorax green or greenish yellow in ground color; thoracic stripes shining; legs yellowish, knees, fore tibiae, and tarsi in part, blackish; crossvein clouded....49. viridicollis

ii Species 5 mm. or less in length

j Thorax reddish with black stripes; scutellum black, abdomen yellow and black; legs and antennae yellow; length 5 mm.; male.....50. jucundus

jj Thorax yellow with a blackish V-shaped mark on the dorsum; abdomen yellow with black band on posterior margins of segments 1 and 2; fourth and part of fifth black; metatarsus 1.25 times as long as the fore tibia (St Vincent Island) 51. longimanus

hh Thorax with grayish, brownish or ferruginous stripes

i With an oval lobe or mace shaped prominence on each abdominal segment; wings with faint cloud on crossvein; length 7.5 mm.....52. lobiferus

ii Abdomen not marked in this manner
j Crossvein pale
k Abdomen yellowish green; black or brown markings in front of the incisures
l Thorax pale greenish, the dilated lines yellowish testaceous with a "longitudinal narrow line very distinct and fuscous on the anterior dilated line;" length 7.5 mm. (=lineola Wied.) (Illinois).....37. lineatus
ll Without fuscous line on the anterior dilated line
m Ground color of thorax pale greenish (when recent); abdomen pale greenish, the segments distinctly tipped with blackish above; length 6.5 to 9 mm. (This may be a synonym of tendens).....53. festivus
mm Ground color of thorax yellowish
n Length 6.5 to 7.5 mm. Abdominal segments slightly darker on apical margin
36. tendens
nn Length 5 mm. or less
o Thoracic stripes brownish; fore metatarsus about one fourth longer than its tibia .....51. longimanus
oo Dark yellow species; abdomen yellow with ferruginous transverse bands on the segments; fore metatarsus one eighth longer than tibia; male
44. fulviventris n. sp.
kk Abdomen not marked thus; species 5 mm. or less in length
l Thorax yellow, not striped; abdomen yellow; fore metatarsus one fourth longer than its tibia; length 2 to 2.5 mm.; male (St Vincent Island) .....54. willistoni nom. nov.
ll Thorax striped
m Abdomen yellow with ferruginous transverse bands on the segments; fore metatarsus about one eighth longer than its tibia; legs yellowish; male
44. fulviventris n. sp.
mm Abdomen more or less brown or dusky
n Abdomen black with the first segment and the distal part of the next 2 or 3 yellowish; fore metatarsus twice as long as its tibia; length 4 to 5 mm.; male (St Vincent Island) .....55. anonymus
nn Abdomen not marked in this manner
o Abdomen black with segments 7 and 8 yellow; the fore metatarsus about one third longer than its tibia (St Vincent Island)
56. innocuus

oo Abdomen brown, posterior margins of anterior segments widely yellowish, with cinereous bloom; crossvein indistinctly clouded; fore metatarsus over two thirds longer than its tibia; length 3 to 4 mm. (Illinois and New York)
57. s i m i l i s n. sp.

jj Crossvein clouded with brown

k Brownish species with strongly defined wing veins; length 6 mm.....58. r e d e u n s

kk Not such species

l Fore tibiae blackish; in mature specimens the dorsal stripes and metanotum black; fore metatarsus 1.5 times longer than its tibia; length 7 to 9 mm.....49. v i r i d i c o l l i s

ll Fore tibiae pale

m Large species 10 or 12 mm. in length; fore metatarsus 1.25 times the length of its tibia; male fore tarsi long haired

n With dusky thoracic stripes
59. p l u m o s u s

nn With reddish thoracic stripes
59a. f e r r u g i n e o v i t t a t u s

mm Smaller species

n Dorsum of thorax whitish or pale cinereous or greenish, with reddish stripes

o Fore metatarsus over 1.33 times its tibia in length; male fore tarsi bare

p Metanotum reddish or brownish, fore metatarsus 1.6 times its tibia; length 5 to 7 mm.....60. d e c o r u s

pp Metanotum blackish; fore metatarsus less than 1.5 times its tibia in length
60a. d o r s a l i s

oo Fore metatarsus about 1.2 times its tibia in length; male fore tarsi hairy; abdominal fasciae reddish, incisures whitish; length 7.5 mm. 61. s t i g m a t e r u s

nn Dorsum of thorax with brown or cinereous stripes

o Length 3 or 4 mm.; fore metatarsus about two thirds longer than its tibia
57. s i m i l i s

oo Larger species

p Fore tarsi of male bare

q Male claspers slender; fore metatarsus about 1.5 times its tibia in length; dorsum of thorax yellow with brownish gray stripes; head blackish; length 8 mm.
62. c r i s t a t u s

qq Male claspers stout; abdomen gray, segments with pale margins
62a. tentans

pp Male fore tarsi with long hairs; fore metatarsus about one fourth longer than its tibia; abdomen with a tinge of green. (=intermedius)
63. prasinus

Auxiliary key to species of Chironomus (sens. lat.)

This key contains those species of the group Chironomus, the descriptions of which are too brief or imperfect to permit of a place in the foregoing or in the keys which are to follow. With but three exceptions the species contained in it were described by Francis Walker:

a Abdomen dark. Species with brown, gray or black thorax, usually not striped

b Hairy black species, 7.5 mm. long; wings white with fuscous costa; halteres a dirty ochre; Arctic species.....64. polaris Kirby

bb Not as above

c With dark halteres

d Species 5 mm. or more in length; legs dull yellow; hairy; fore feet very long.....65. attenuatus

dd Less than 2 mm. in length

e Length 2 mm.; chest thick; wings white; bare; male
66. crassicollis

ee Length 1 mm.; wings hyaline; hairy?.....67. fimbriatus

cc With pale halteres

d Tibiae and tarsi with black articulations; black species; 4.5 mm. long; abdomen yellow at base; wing with cross band; bare
68. nigritibia

dd Not as above

e Gray species; abdomen black with white rings; length 6 mm.; Arctic species.....69. borealis Curt.

ee Brown species

f Species 6 mm. long. Thorax reddish striped, pleura whitish; abdomen dark brown, incisures paler; wings whitish, bare; male .....70. albistria

ff Species less than 4 mm. in length

g Length 3.5 mm. Thorax brown, gray-striped; halteres yellow; wings hairy? male.....71. brunneus

gg Length 1 mm. Thorax brown; halteres pale brown; wings hairy? .....67. fimbriatus

aa Abdomen usually pale; species with green, pale red or yellow thorax; striped, excepting in a few of the palest

b Abdomen dark brown, or if not, then with black markings or margins on the anterior segments

c Posterior margin of segments black; thorax with broad black stripes; scutellum black; length 5 mm.; male....50. jucundus

cc Abdomen brown with paler margins

d With metathorax black, femora yellow, tarsi dark, wings with the usual spot; hairy? Length 5 mm.; male.....72. lasiopus

dd Not as above

e Thorax reddish, striped, with two white side stripes; pleura hoary; scutellum pale red; legs pale tawny; tips of thighs, shanks, and feet darker; wings bare. Length 6 mm. 70. albistria

ee Thorax testaceous with three brown stripes; pleura pale with dusky spots; abdomen with spots on sides of last two segments; middle and hind tibiae dusky; wings unspotted (see Orthocladius) .....oceanicus Packard

bb Abdomen, basal half at least, yellow or green, no black markings on anterior segments

c Wings with a brown cross band; body straw-colored; length 3 mm.; male (habitat unknown).....73. hilaris

cc Wings without band

d With brownish or reddish abdomen and thorax

e Fuscous species 3.5 mm. long; male; wings hairy? 71. brunneus

ee Abdomen brown with broad, dingy, yellow bands on posterior part of the segments; metathorax black; wings with stigma; hairy? Length 5 mm.....72. lasiopus

dd With yellow or greenish thorax and abdomen

e Species 5 mm. or more in length

f Large species 9 mm. in length, with green thorax; abdomen yellow; wings white; hairy? (See the genus Eurycnemus) .....lasiomerus

ff Species 5 to 6 mm. in length

g Saffron or pale orange-colored species; legs pale yellow; wings hyaline, fringed, hairy? Female. (See the genus Eurycnemus) .....unicolor

gg Thorax silky white with three tawny stripes; abdomen yellow, last two segments dull; legs yellow, a tawny band around each thigh; wings hairy?....74. anticus

ee Species 2.5 mm. or less in length

f General color citron yellow; the thoracic stripes each with a black dot at tip; wing bare? Length 2.25 mm. 75. bimacula

ff Without black dot at tip of each thoracic stripe

g Thorax pale yellowish green, with three dull red stripes; metathorax brown; length 2 mm.; male and female; wings hairy?.....76. confinis

gg General color yellowish green

h Length 1.5 mm.; antennae pale brown; wings deeply fringed; hairy?.....77. pellucidus

hh Length 2 mm.; antennae yellow; male; wings hairy? 78. trichomerus

1. Chironomus brachialis Coquillett.

1901 Chironomus Coquillett. Proc. U. S. Nat. Museum. 23:607
1902 Chironomus ?atrimanus Coq. Proc. Nat. Mus. 25:94

Male. Head black, the face brownish yellow, mouth parts brown, first joint of antennae black, the others yellow, hairs of antennae pale yellow, changing into white at their apices; thorax and scutellum black, polished; abdomen yellow, middle of dorsum of second segment prolonged to the lateral margin at the hind end, on the front end extending entirely around the segment, narrow bases of the three succeeding segments and whole of the following ones, including the genitalia, brown; legs yellow, apex of front femora, front tibiae and their tarsi except the basal two thirds of first joint, knees of other legs, apices of their tibiae, sutures of first three tarsal joints and whole of the two following brown, front tarsi fringed with rather long hairs on outer side of second and third joints; wings bare, basal portion hyaline and with yellow veins, the remainder grayish hyaline and with brownish veins, an indistinct darker brown spot on the small crossvein; halteres yellow. Length 5 mm.

Female. As in the male except that the first antennal joint is yellow, broad humeral region tinged with yellow, second and three following abdominal segments largely brownish (front tarsi wanting), wings with a broad brown cross band which in its outer portion includes the small crossvein. Habitat Westville, N. J.

A male specimen from Ithaca, N. Y., agrees with the above description excepting that the antennal hairs are wholly yellow. In this specimen the thorax when viewed obliquely is faintly pollinose; the last three abdominal segments are flattened; the genitalia rather short; the fore metatarsus is about one fourth longer than its tibia; and the venation as shown on pl.28, fig.1.

2. Chironomus atrimanus Coquillett

1902 Chironomus Coquillett. Proc. U. S. Nat. Mus. 25:94

This may possibly be identical with the preceding.

Female. Head yellowish brown, antennae yellow, the last joint and the mouth parts brown; thorax and scutellum black, highly polished; abdomen somewhat polished, black, the first segment yellow, hind margins of three to six yellowish; legs yellow, front tibiae and their tarsi black, apices of femora, both ends of middle and hind tibiae, apices of joints of their tarsi and whole of the last two joints blackish, front tibiae four fifths as long as the first joint of their tarsi; wings strongly tinged with yellow on the basal third, followed by a wide brown band extending from costa to fifth

vein (cubitus) remainder of wing hyaline; halteres yellow; length 4.5 mm. Kansas City, Missouri.

3. Chironomus varipennis Coquillett

1902 Chironomus Coquillett. Proc. U. S. Nat. Mus. 25:94

Male. Head and body dark brown, a large dull yellowish humeral spot, antennae except the first joint yellow, the hairs gray; thorax opaque, largely gray pruinose, narrow hind margins of abdominal segments gray pruinose; femora brown, the ends narrowly and a band before the apex of each, yellow; front tibiae very short, yellow, the bases brown, other tibiae brown, an indistinct yellowish ring beyond the base; front tarsi wanting, the others yellow; wings whitish, marked with 11 brown spots as follows: Three in a row behind the fifth vein (cubitus), one before middle and another in middle of apical margin of third posterior cell (cell Cu_1) one in base of first posterior (cell R_{4+5}), another in the cell below it, and a third midway between the latter and the base of this cell, one in middle and another in apex of first posterior cell (cell R_{1+5}), also a small one in apex of second posterior cell (cell M); halteres whitish; length, 3 mm. Las Vegas, Hot Springs, N. M.

4. Chironomus octopunctatus Loew

1861 Chironomus Loew. Wiener Ent. Monatschr. 5:33
1878 Chironomus O. S. Cat'l. N. A. Dipt. p.21

Male and female. Pallidly yellow, the tips of femora and tibiae black, wings with four blackish spots. Length 1.2 mm., wing 1.3 mm.

Very pale yellow, legs whitish; posterior part of the thorax shining white and on each side with a darker line. The abdomen fuscous with posterior margin of each segment pale yellow. The tips of the femora rather widely, and of the tibiae rather narrowly, black. Anterior tarsi six times longer than the tibiae. Wings whitish, veins pale yellow; each wing with four blackish spots, in certain lights iridescent; the first is at the anterior fork, the second is between that and the tip of the wing; the other two are at the posterior margin; one of them, composed of two contiguous spots, is situated where the second branch of the cubitus enters the wing margin, the second one midway between this and the base of the wing. Cuba. Translation. Loew, loc. cit.

5. Chironomus scalaenus Schrank

1803 Tipula Schrank. Fauna Boica. 3:73, 2324
1818 Chironomus Meigen. Syst. Beschr. 1:54
1850 Chironomus Zetterstedt. Dipt. Scand. 9:3501
1864 Chironomus Schiner. Fauna Austr. 2:600
1877 Chironomus V. d. Wulp. Dipt. Neerl. 1:266

Head dark brown; the palpi lighter, the antennae yellowish, the antennal hairs of the male pale brown. Thorax and abdomen blackish brown, the thorax sometimes a little lighter with indistinct stripes; the next to the last abdominal segment of the male is broad, the last much smaller; the claspers yellowish, filiform, quite long; the hairs of the abdomen pale yellow. Legs pale yellow; the extreme tip of each tibia with a brown spot; the fore metatarsus is fully twice as long as its tibia; the fore tarsi of the male slightly hairy, yet not bearded. Halteres pale yellow. Wings with a whitish tint and three gray spots which are particularly distinct in the female; one in the anal cell, another in the fork of the cubitus and the last distad of the crossvein. Length 2 to 2.9 mm. Translation. V. d. Wulp. loc. cit.

This fly has been recorded from New Hampshire. About a dozen specimens, male and female, from Ithaca, N. Y. and Washington State agree with the above description excepting in the following particulars: The space separating the two larger spots upon the wing is filled by a very faint cloudiness; the thorax and abdomen are rather brownish in color, the segments of the latter with indistinct paler posterior margins, in some specimens the bases of the femora and the tarsi are slightly infuscated and the fore metatarsus is $1\frac{3}{4}$ instead of twice as long as its tibia. The length also ranged from 1.5 to 2 mm. instead of from 2 to 3 mm. (pl.28, fig.2). As I had no European specimens for comparison I hesitated to pronounce my specimens as distinct species.

6. Chironomus spilopterus Williston

1896 Chironomus Williston. Trans. Ent. Soc. Lond. 273

(Pl.28, fig.3)

Male and female. Face and front yellowish brown. Basal joint of antennae brownish-yellow; flagellum brownish, the plumosity of the male antennae blackish gray. Mesonotum brown or yellowish brown, lightly white dusted; in well preserved specimens brown vittate on the sides, and in front in the middle. Pleura black, in part luteous. Scutellum yellow or yellowish brown. Abdomen black, with yellowish hair; in the male, slender; in the female, broader, and with whitish posterior margins to the segments. Legs yellow, with rather abundant yellow hair; femora in part brown or brownish; front tibiae not more than one half of the length of the front metatarsi. Wings whitish hyaline, with pale blackish spots, which are more distinct when seen obliquely, and situated as follows: One near the base, another near the middle, and a third near or at the tip of the first posterior cell

(cell R_{4+5}); a streak near the middle, and a spot near the tip of the cell in front of the forked cell; a spot on the posterior branch of the furcation, and one or two in the anal angle. Length 1.75 to 2.25 mm. St Vincent Island.

7. Chironomus fascipennis Zetterstedt

1838 Chironomus Zett. Ins. Lappon. 813, 21
1850 Chironomus Zett. Dipt. Scand. 9:3505
1864 Chironomus Schiner. Fauna Austr. 2:599

Male. Wholly pale yellow, not shining; the antennae testaceous, somewhat infuscated, the first joint yellow, the hairs sordidly yellow. The eyes black. The palpi fuscous. The thorax with three yellow stripes; the wings hyaline, with two moderately wide fuscous cross bands, one at the middle of the wing, rather faint, the other a little more distinct at the tip; besides this there is a fuscous spot at the base. Halteres white. The legs pale, somewhat pilose, middle and hind tibae with black tips. Anterior tarsi bare. Length 3.5 mm. New Jersey (Johnson).

8. Chironomus taeniapennis Coquillett

1901 Chironomus Coquillett. Proc. U. S. Nat. Mus. 23:607
1902 Chironomus ?pulchripennis Coquillett. Proc. U. S. Nat. Mus. 25:94

Female. Yellow, tinged in places with green, especially on the abdomen, mouth parts, apical half of the femora, bases of front and middle tibiae and nearly the whole of the hind ones brown, metanotum marked with a transverse pair of triangular brown spots; wings whitish, the costal cell from the humeral crossvein to apex of auxiliary vein (Sc), a cross band extending from the latter point to hind margin of wing where it is greatly dilated, finally the apical fourth of wing, black. Length 4 mm. Massachusetts, New Jersey. Coquillett, loc. cit. Illinois, New York, South Dakota, Pennsylvania.

Upon a comparison of the above description with that of pulchripennis it will be seen that they greatly resemble each other. The examination of a series of Ithaca specimens shows considerable variation in the extent of the dark coloring. To the description I may add that the male does not differ from the female except that the flagella of the antennae are brownish; the genitalia yellow, the lateral arms long, the keel slender, curved, and not much enlarged. In the living specimen the general color is quite green, but upon drying some specimens become almost yellow. The abdominal markings are variable; in some

the last four segments have upon them irregular blotches of brown or black. The posterior end of the lateral thoracic stripes range from a pale yellow in some specimens to a dark brown in others; depending, perhaps, upon their maturity. The amount of black upon the legs is also variable; in an extreme case all the tibiae and the femora except the immediate bases of the latter are black. The fore metatarsus is about one fourth longer than its tibia. Described from numerous specimens (pl.28, fig.4). I have a purchased specimen, collector unknown, bearing the label, C. fascipennis Zett., Riverton, N. J., which is not the latter species but is C. taeniapennis.

9. Chironomus pulchripennis Coquillett

1902 Chironomus Coq. Proc. U. S. Nat. Mus. 25:94

This seems to be a synonym of C. taeniapennis Coq.

Female. Head and antennae yellow, apical half of last joint of the latter and the mouth parts brown; thorax opaque, greenish yellow, mesonotum marked with a pair of lateral brown vittae behind its middle, metanotum with a pair of brown spots which approach each other posteriorly; scutellum and abdomen green, the latter with the hind margins of the segments yellowish, bases of segments six to eight and nearly the whole of the following two brown; legs whitish, the knees black, this color extending nearly to the middle of the middle and hind femora, front tibiae $\frac{4}{5}$ as long as the first joint of their tarsi; wings whitish, the costal cell except its apex brown, a broad brown band crosses the wing, passing over the bases of the first and third posterior cells (cells R_{4+5} and Cu_1) and prolonged along the hind margin nearly to the anal angle, apex of wings broadly brown from the third vein (R_{4+5}) to the upper branch of the fifth (cubitus); halteres white; length 4 mm. Franconia, N. H. Coquillett, loc. cit.

10. Chironomus brunnipes Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3518, 35
1898 Chironomus Lundbeck. Vidensk. Meddel. 273

Black, subshining, thorax of the male the same color, thorax of the female yellow with three black stripes; the antennae and the legs brown; the wings white; the anterior tarsi of the male bare; the metatarsus is a little longer than the tibia; caudal appendages small, short subfiliform. Length 2.7 mm.

Male. Brownish black. Antennae with brown plumosity. Abdomen very narrow, linear, hairy. Caudal appendages short subfiliform, dusky. Wings white, crossvein not clouded; halteres white. Legs brown, tarsi paler, the fore metatarsus is about 1.5

times as long as the tibia, but is twice as long as the second tarsal joint; the remaining joints gradually decreasing in length; legs slender and bare.

Female. Dorsum of thorax yellow with three black stripes. Abdomen rather stout, pubescent. In other respects like the male. Translation. ? Greenland. (Lundbeck.)

11. Chironomus brunneipennis n. sp.

Resembles albimanus Meigen but differs in being slightly larger, in having the knob of the halteres fuscous, and in having the fore metatarsus nearly twice as long as its tibia.

Female. Shining black; legs partly brown. Length 3.5 mm. Head black, proboscis, palpi and antennae fuscous. Thorax including scutellum, metanotum, pleura and pectus shining black; humeri fuscous. Abdomen black, subopaque. Legs brownish; coxae yellowish, femora brown, fore pair yellowish on basal half; tibiae yellowish brown; tarsi brown excepting basal half or two thirds of the metatarsi which are yellowish or brownish yellow. Wings hyaline, very slightly smoky; anterior veins and the crossvein brown, posterior veins yellow. Halteres fuscous, stem yellowish. Ithaca, N. Y.

12. Chironomus caliginosus n. sp.

(Pl.22, fig.5)

Female. Fuscous; legs partly brown; wings smoky. Length 6 mm.

Head, including palpi and proboscis fuscous. Antennae ferruginous, the basal joint and the incisures yellow, apical joint darker. Dorsum of thorax yellow, gray pollinose with three dull black stripes; pleura, sternum, metanotum, and scutellum fuscous. Abdomen fuscous with yellow hairs; posterior margin of segments very slightly grayish; when viewed obliquely from behind the apical half of each segment appears gray pollinose. Fore coxae pale brown, the others fuscous; femora brown; fore femora with basal two thirds and middle femora with basal one half yellow; all tibiae brown; tarsi yellow, tips of the joints brown; fore metatarsus 1.5 times as long as its tibia. Wings smoky, especially along the course of the veins; veins reddish brown including crossvein. Halteres white, with end of knob brown. Two specimens. Ithaca, N. Y.

13. Chironomus niveipennis Fabricius

1805 Chironomus Fabr. Syst. Antl. 42, 21
1818 Chironomus Meigen. Syst. Beschreib. 1:51, 73
1850 Chironomus Zett. Dipt. Scand. 9:3566, 92

1864 Chironomus Schiner. Fauna Austr. 2:598
1877 Chironomus V. d. Wulp. Dipt. Neerl. 269, 40
1895 Chironomus Johnson. Proc. Acad. Nat. Sc. Phil. 320
1838 Chironomus obscurus Zett. Ins. Lappon. 815, 31
1830 Chironomus pilicornis Meigen. (nec. Fabr.). Syst. Beschr. 6:254
1838 Chironomus rudis Zett. Ins. Lappon. 809, 3

Larva and pupa. Miall and Hammond (1900) state that the larva inhabits a tube and that it possesses red blood. There are no ventral blood gills. The pupa has a tail fin composed of thirty or forty long setae, and the abdominal segments are laterally expanded. On the second abdominal segment are paired posterolateral transparent appendages of small size, enclosing blood spaces. There are two conical prominences, each bearing a long seta, on the vertex of the head. The tracheal gill divides into three primary branches as usual. The secondary branches are comparatively few; each encloses a number of tracheae which pass to the ultimate branches.

Imago, male. Black; dorsum of the thorax dark gray, with three black longitudinal stripes, scutellum sometimes brown; abdomen black, at the incisures a little more gray, the last few segments somewhat wider and flattened (as with the males generally), hairs dark, the forceps short and black, the arms slender. Head, antennae and palpi black. Legs black, the tibiae and the tarsi often brownish, the fore tarsi of the male densely bearded with brown hairs; the metatarsus a little longer than the tibia. Wings whitish, the anterior veins more distinct, the crossvein black. Halteres dark. The female does not have the bearded fore tarsi and her halteres are often sordidly white. Length 6 to 7 mm. Schiner, loc. cit.

Florida (Johnson). Some specimens from South Dakota which I identify as this species have both anterior and posterior margin of each abdominal segment grayish, the posterior most distinct; the fore tarsi of the male long but rather sparsely haired, and the fore metatarsus about one-eighth longer than its tibia; the second, third, fourth and fifth fore tarsal joints gradually decreasing in length.

14. Chironomus hyperboreus Staeger

1845 Chironomus Staeger. Kröjer: Naturh. Tidsskr. n. s. 1:349
1878 Chironomus Osten Sacken. Cat'l. N. A. Dipt. 20
1898 Chironomus Lundbeck. Videnskab. Meddel. 272, 49
1865 Chironomus polaris Bohem. Ofv. K. Vet. Akad. Förh. 574, 18

Blackish, thorax grayish, with three black stripes, abdomen black, with narrow whitish fasciae, wings white with a black spot. Length 7 to 8 mm.

Male. Legs black, the anterior tarsi densely bearded.

Female. Legs fuscous-brown, fore femora testaceous at the base.

"The plumes of the male antennae are black, the abdomen is black, that of the female nearly coal-black, with narrow, sharply marked whitish posterior margins of the segments. The legs are black, those of the female more brownish, the fore femora with a somewhat yellowish base. . . . The fourth tarsal joint of the fore legs is about three quarters the length of the third. The male fore tarsi are densely bearded." Greenland. Staeger, loc. cit.

The male specimens with bare fore tarsi described by Staeger (loc. cit.) as varieties from Greenland, have been separated by Lundbeck (1898) as a distinct species under the name of C. staegeri (q. v.)

15. Chironomus staegeri Lundbeck

1898 Chironomus Lundbeck. Vidensk. Meddel. 271, 48
1838 Chironomus annularis Zett. Ins. Lappon. 809, 2
1845 Chironomus hyperboreus Staeger. Kröjer: Natur. Tidsskr. n. s. 1:349
1869 Chironomus Holmgr. K. Svensk. Vet. Ak. Handl. 8:46

This name was given by Lundbeck to those specimens which Staeger (loc. cit.) considered a variety of C. hyperboreus differing from the type in having the anterior tarsi of the male bare.

Male. Antennae nearly as long as the thorax, fuscous black, densely plumose, palpi black. Thorax black, scarcely shining, cinereous puinose; the mesothorax with short hairs, the usual three stripes more or less distinct; the scutellum elevated, bristly. The abdomen fuscous black, pale haired, the apical margin of each segment hoary or cinereous, the caudal appendages narrow and bristly. The wings narrow, cinereous, whitish or lightly smoky tinted, toward the costal margin a little darker; anterior veins strong and dark, the others pale and translucent; the radial veins straight, toward the tip nearly parallel with the media; the subcostal vein slightly curved, the peduncle of the cubitus extends but very little distad of the tip of the basal cell, the branches slightly curved. Halteres dirty white, the tip of the knob and the base of the peduncle often darker. Legs fuscous black, the middle and hind pairs rather long-haired, the fore tibiae and tarsi thinly and shortly haired, fore metatarsus one fourth longer than its tibia.

Female. Similar to the male but the dorsal thoracic stripes are more distinct, apical margins of abdominal segments more widely cinereous or sometimes pale gray; the radial veins lightly curved at the tip; the legs sometimes dilutely black fuscous, sometimes paler. Length 6.5 to 7.5 mm. Greenland. Holmgren (loc. cit).

16. Chironomus flavicingula Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:20
1878 Chironomus Ost. Sack. Catal. Dipt. N. A. p.20
(Pl.28, fig.6, and pl.32, fig.7)

The blood-red larvae of about 12 mm. length were dredged from the sand in the bottom of a shallow pond near Ithaca N. Y.

Larva. (Pl.21, figs. 13 to 19.) Head dark brown; antennae short; labrum with about ten pairs of pale setae, two or three pairs of which are quite short (fig.15, under surface fig.14); at extreme apex with a pair of fan-like appendages (f), which hang downwards, though shown in the figure folded out in a horizontal plane; caudad of this there is a comb with long, fine, caudad projecting teeth. The epipharynx (fig.13) with three cephalad projecting fan-like organs (f^1) forming the "posterior comb," five or six lateral setae (s), several pairs of ventrad projecting curved and branched setae (s); caudad of these is an arched chitinized piece (fig.13b); laterad of this are the dark brown, chitinized, caudad and ventrad curved lateral arms not shown in the figure. The black tipped mandibles are as usual, with the mesad projecting branched hairs, and two laterad projecting setae; each maxilla (fig.19mx) has prominent palpus, a large seta and numerous papillae on the mesal margin, a pair of large setae at the base of the palpus, another pair (not shown in figure) at base of the mandible. The hypopharynx (fig.19hy) has a rounded apical margin with numerous short hairs and papillae. The labium (fig.18 and fig.19 l) has a broad, blunt, central tooth and six small laterals on each side. There are two long setae upon each side of the head below the eyes. The fore feet are short, with very numerous, short, curved, yellow setae. The body seems to be entirely devoid of hairs. Each posterior foot is provided with a number of bilobed brown claws. The dorsocaudal papillae of the last segment are about as long as wide, with 6 or 7 long setae at the tip, and one or two short ones on the side; caudad of these and immediately above the upper pair of blood gills are two more long setae. The blood gills of the eleventh segment are present; those of the twelfth are nearly as long as the posterior feet; slightly conical and four in number.

Pupae. The pupa is dusky in color when nearly mature, showing the colors of the imago. The respiratory filaments are white,

conspicuous in the living specimen and much branched, the setae markings upon the dorsum of each abdominal segment as is shown in fig.16; the seventh and eighth segments are entirely without, and the sixth usually has but few, setae. The posterior margin of the second has the usual black longitudinally ridged fascia. The lateral fin of the eighth segment, together with the terminal spur, are shown in fig.17. The caudal paddle is fringed with long, pale, delicate, matted hairs.

Imago, male. Body gray, with two large white spots on each side of the chest; abdomen fringed with hairs on each side, and having a white silvery band on the hind border of each segment; feelers black; legs black, hairy, a yellow ring near the tip of each thigh, and two yellow rings round each shank; feet dull yellow towards the base; wings colorless, with the usual dark spot on each; veins pale brown; poisers gray. Length of body 5.5 mm., of the wings, 10 mm. St Martin's falls, Albany river, Hudson bay. Walker, loc. cit.

At the head of the division to which this species belongs, Walker states that the wings are hairy. This, however, is evidently an error. To the above description the following may be added.

Male. Head and occiput black, proboscis and palpi dull black, the former with dark brown hairs. Antennae brownish yellow, the large basal joint black, the hairs dark brown. Thorax wholly black, the dorsum and the scutellum with cinereous bloom, the former with three cinereous stripes, the middle one divided by a fine black line, the hairs pale brown. Abdomen velvet black, the posterior margin of each segment dorsally with a moderately wide white fascia extending to lateral margins. When viewed from behind, the last three or four segments appear to me mottled with cinereous, leaving a black median line on the fifth and sixth segments. Venter dull black; genitalia brownish yellow, moderately long (pl.32, fig.7). Abdomen sparsely covered with long, nearly erect, yellowish hairs. Coxae brownish black, moderately shining; femora brown, excepting the yellow basal articulation and a yellow subapical ring; tibiae cream white, with brown base and tip; the brown of the front pair quite pale, the hind pair having in addition a median ring which is sometimes indistinct. In some specimens the basal half of fore tibiae is also brown. Tarsi cream white, the tips of all joints and the whole of the fifth brown, the brown of the fore pair being quite pale. The anterior tarsi are delicately bearded. The anterior metatarsus about one fifth longer than its tibia. Wings hyaline, crossvein dark brown; venation as figured. Halteres brownish yellow with apical half of the knob dark brown.

Female. Like the male, excepting in the following particulars: Tips of antennal joints reddish brown, the hairs pale; thorax with a little more cinereous coloring, the hairs upon the abdomen a little shorter; fore tarsi bare. Described from a number of specimens. Ithaca, N. Y., Kansas.

17. Chironomus halteralis Coquillett

1901 Chironomus Coq. Ent. News. p.17
(Pl.28, fig.7)

Head black, palpi and antennae yellowish brown, plumosity of male antennae dark gray; thorax dark brown, the anterior end tinged with yellow, a pair of broad, gray pruinose vittae on the posterior half of the mesonotum, the hairs light yellow; scutellum dark yellow; abdomen black, slightly polished, thinly covered with rather long yellow hairs; femora, tibiae and tarsi yellow, bases of femora slightly tinged with brown; front tarsi slender, almost as long as the body, destitute of hairs, the first joint about twice as long as the front tibia; middle and hind tibiae and their tarsi in the male, thickly covered with rather long yellow hairs, much sparser in the female; halteres pale yellow, the knobs black; wings bare, hyaline, the apical half slightly darker, veins in the basal half yellow, in the apical half more brownish; length 2 to 3 mm. Washington, D. C. Coquillett loc. cit.

A number of specimens from Ithaca, N. Y., agree with this description.

18. Chironomus nitidellus Coquillett

1901 Chironomus Coq. Proc. U. S. Nat. Mus. 23:608

Male. Head black, mouth parts yellow, antennae, except the basal joint, yellow, the hairs whitish; body black, polished, the first two abdominal segments and the claspers yellow; legs yellow, the femora except their bases, front tibiae wholly, and apices of hind ones brown, front tarsi bare; wings bare, whitish hyaline, the veins brown, halteres yellow; length, 2.5 mm. Riverton, N. J. Coquillett loc. cit.

19. Chironomus fallax n.sp.

(Pl.28, fig.8)

Female. Black; first abdominal segment yellow or greenish; legs partly black. Length, 3.5 mm.

Head, including proboscis, palpi and antennae yellowish, the basal joint of the latter somewhat brownish. Thorax cinereous black, with three broad shining black stripes, more distinct when viewed obliquely. Pectus, pleura, and scutellum brown, the

last sometimes paler. Abdomen fuscous, the first segment yellowish-green, in living specimens bright green; the remaining segments more or less distinctly marked with sordidly yellow hind margins; hairs pale brown or yellowish. Fore coxae brown, middle and hind pairs yellow. Legs cream white, the fore femora excepting their bases and tips dark brown; tips of middle and hind tibiae each with minute black comb; pulvilli present, empodium pectinate. Fore metatarsus about 1.4 times as long as its tibia. Wings hyaline with a milky tinge; veins slightly yellowish; venation as shown in figure; halteres yellowish. Ithaca, N. Y.

20. Chironomus riparius Meigen

1804 Chironomus Meigen. Klass. 1:16, 3
1818 Chironomus Meigen. Syst. Beschr. 1:23, 6
1850 Chironomus Zett. Dipt. Scand. 9:3489, 7
1864 Chironomus Schiner. Fauna Austr. 2:603
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.253, 8
1895 Chironomus Johnson. Proc. Acad. Nat. Sc. Phil. 320
1898 Chironomus Lundb. Vidensk. Meddel. p.272, 50
1826 Chironomus annularis Macq. Recueil Soc. Sc. Agri. Lille. p.194, 2
1826 Chironomus viridipes Macq. Recueil Soc. Agri. Lille. 195, 4
1838 Chironomus zonulus Zett. Ins. Lappon. p.810, 7

(Pl.28, fig.9)

Male and female. Dorsum of the thorax, especially in front of the scutellum, light gray, with three black longitudinal stripes, the median one divided by a fine line, abbreviated posteriorly though continued to the scutellum by a black line; the lateral stripes abbreviated anteriorly; scutellum gray or grayish yellow; the metanotum gray. Abdomen black, the posterior margins of the segments sometimes with wide, sometimes more narrow whitish bands; the posterior segments gray; forceps small. The antennae brown, the hairs of the same color; the palpi darkened. Legs brownish, yellow or pale yellow, the femora sometimes with a greenish tinge, the articulations dusky; the fore tarsi of the male not hairy; the metatarsus 1.5 times longer than the tibia; the second tarsal joint one half as long as the metatarsus but longer than the third; third and fourth about equal in length. Wings whitish, with a small brown spot. Halteres yellowish. The antennae of the female are yellow at the base. Some specimens have the humeri yellowish or greenish, but these may be distinguished from nearly related forms by their slender fore tarsi. Length 6.75 to 9 mm. Translation in part from Schiner, loc. cit.

According to V. d. Wulp, loc. cit., and Weyenbergh (1874) the larvae are transparent and pale green; some larvae from which I bred this species resemble C. decorus n. sp. in the form of the labium as well as in other details. Ithaca, N. Y.; Idaho; Washington State; Pennsylvania; South Dakota; Minnesota; New Jersey; Douglas, Alaska.

21. Chironomus barbipes Staeger

1839 Chironomus Staeger. Kröjer: Naturh. Tidsskr. 2:561, 5
1850 Chironomus Zett. Dipt. Scand. 9:3486, 5
1864 Chironomus Schiner. Fauna Austr. 2:601
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.252, 6

(Pl.28, fig.10)

Male. Hairy, blackish species with hyaline wings having the anterior veins somewhat reddish; halteres sordidly yellow, the extreme tips a little darker; the second joint of the fore tarsus shorter than the third. Length 8 mm.

Head and basal joint of antenna dull black, the flagellum of the latter and the palpi fuscous. Antennal hairs dark reddish brown. Thorax cinereous, with three faintly marked wide cinereous black stripes; scutellum, pectus, pleura and metanotum cinereous. Abdomen black, the posterior margins of the segments cinereous, covered with long brown erect hairs. Genitalia brown, the claspers rather short and stout, the dorsal keel of moderate size. The coxae cinereous; the legs testaceous, the bases of the femora, the knees, the tips of the tibiae, and the middle and hind tarsi a little darker, the fore tarsi except basal half of metatarsus brown and densely bearded with long brown hairs. The fore femora and tibiae and basal half of metatarsi nearly bare; the whole of the middle and hind legs quite hairy. Fore metatarsus about one sixth longer than its tibia; the *second tarsal joint shorter than the third.* The wings narrow and long, hyaline with very slight yellow tinge; the costa, radius, R–M crossvein and the basal half of the media testaceous, the other veins hyaline; venation as figured. Halteres yellowish.

Female. Basal half of antennae yellowish, fore tarsi bare. Readily distinguished from related species by its short second tarsal joint.

Van der Wulp (1877, p.252), suggests that this may possibly be a synonym of C. pallens Meigen.

Two male specimens, Chicago, Ill., May, 1899.

22. Chironomus annularis Degeer

1776 Tipula Degeer. Mem. pour serv. a l'hist. d. Ins. 6:379, 18
1809 Chironomus Latr. Gen. Crust. et Ins. 4:250
1818 Chironomus Meigen. Syst. Beschr. 1:21, 3

1850 Chironomus Zett. Dipt. Scand. 9:3485, 4
1864 Chironomus Schiner. Fauna Austr. 2:602
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.253, 7
1804 Chironomus annulatus Meigen. Klass. 1:12, 2
1818 Chironomus pallens Meigen. Syst. Beschr. 1:22, 5
1818 Chironomus tristis Meigen. Syst. Beschr. 1:48, 62

This species resembles riparius but differs in having the posterior margins of the abdominal segments grayish, not sharply separated from, but blended into, the black; and in having the third and fourth tarsal joints of the fore legs subequal in length.

Male. Head and antennae blackish, palpi and proboscis fuscous. Dorsum of the thorax cinereous with three dull, black stripes; metanotum, pleura, and sternum dull black, slightly pruinose; scutellum fuscous. Abdomen fuscous or black, the posterior margins of the segments grayish, the hairs yellowish, genitalia small, black. Coxae blackish; legs subfuscous, tarsi slightly darker. Fore metatarsus about one fifth longer than the tibia, the third and fourth tarsal joints about equal in length, the fore tarsi and the middle and hind legs long-haired. The wings hyaline, the anterior veins dark, particularly the crossvein. The venation as figured (pl.28, fig.11). Halteres whitish. Length 7 to 8 mm.

Female. Like the male but the anterior tarsi are bare, and in the single specimen the tips of the femora are darkened. Ithaca, N. Y. A darker variety (var. tristis Meig.) with slightly infuscated halteres from Washington State.

I have compared my specimens with specimens from Europe and can detect no differences.

23. Chironomus dispar Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:247, 85
1850 Chironomus Zett. Dipt. Scand. 9:3506, 22
1864 Chironomus Schiner. Fauna Austr. 2:604
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.257, 13
1838 Chironomus lucidus Zett. Ins. Lappon. p.810, 5
1850 Chironomus Zett. Dipt. Scand. 9:3509, 25

Shining black; the abdomen somewhat brownish, with paler hairs and occasionally reddish yellow lateral spots; the anal segment narrower and shorter than the preceding segment; the forceps strong, its arms nearly as long as the last abdominal segment. Head black, the palpi brown, the antenna together with its hairs blackish. The legs yellow, the coxae brown; the tibiae brown at the tip, fore tarsi delicately ciliate, the metatarsus one half longer than its tibia. Wings whitish. The crossvein not

darkened. The female has yellow antennae, the abdomen is without spots, and the legs are of a more pronounced whitish yellow. Length, 7 mm. Translation in part from Schiner. New Jersey. (Johnson.)

24. Chironomus albimanus Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:40, 45
1850 Chironomus Zett. Dipt. Scand. 9:3551, 77
1864 Chironomus Schiner. Fauna Austr. 2:604
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.268, 38
1804 Chironomus annularis Meigen. Klass. 1:17, 16

Male. Head black, proboscis, palpi and antennae sordidly yellow, basal joint of the last black; antennal hairs brownish. Dorsum of the thorax shining black, sometimes with faint indications of three fine cinereous lines; scutellum, metanotum, pleura and pectus shining black. In immature specimens the thorax is more brownish and the stripes are wider. Abdomen shining black; the anterior segments fuscous; the hairs and the genitalia yellowish, the claspers of the latter slender and short; coxae shining brown or black; legs pale yellowish, apical one half or two thirds of all the femora, the whole of the fore tibiae and the extreme tips of the middle and hind ones black or deep brown; each fore tarsus with its first joint whitish, the others slightly infuscated; anterior legs bare; fore metatarsus $1\frac{1}{3}$ times as long as its tibia. Wings hyaline with a slightly smoky tinge; veins including crossvein yellowish and distinct; venation as figured (pl.28, figs. 12, 13). Halteres whitish. Length 4 mm.

Female. Like the male, but the abdomen is nearly wholly shining black in matured specimens and the veins of the wings seem a little darker. Length 3 mm. Ithaca, N. Y. The American agree perfectly with my European specimens.

25. Chironomus tenellus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.812, 15
1850 Chironomus Zett. Dipt. Scand. 9:3517, 34
(Pl.21, figs. 1 to 4)

Larva. The larva is pale red, 4 to 5 mm. in length. Head brown, about 1.5 times as long as wide, with a few small dorsal setae. Antenna (fig.4) short, about three fourths as long as the mandibles, the basal segment being three fifths of the total length. The labrum (fig.1 ulr.) has upon its lower surface the normal three pairs of large setae and three pairs of smaller ones. The epipharynx (fig.1) has the usual lateral arms (la) with the dark colored extremities, the transverse comb with 5 or 6 blunt, rather indistinct teeth, and the stout curved pectinate hairs. The mandible (fig.1 md) is stout, with blackened teeth, a longitudinal

row of hairs on the dorsal side (not shown in the figure) overhanging the teeth, a long prominent seta on its lateral surface, and a few long much branched setae on the dorsal surface of the mesal margin. The maxilla (fig.1 mx) has a short stout palpus, a few short setae and papillae and a group of delicate mesad projecting filaments. The labium (fig.1 l) has a black margin, the middle tooth is rounded, the second laterals are small and closely united to the first laterals. The anterior and posterior prolegs are as usual with the species of Chironomus, the claws of the posterior pair are bilobed; caudad of the anal papillae with their tufts of setae, is a conspicuous pair of spines or bristles. The papillae mentioned above are somewhat infuscated at the tip. The anal blood gills are present, though none were discovered on the ventral surface of the eleventh segment.

Pupa. The pupa is brownish, about 4 mm. in length. The two respiratory organs, each composed of numerous white filaments, are conspicuous. The abdominal segments have the microscopic spines covering nearly the whole dorsal surface (fig.3). There are two patches near the anterior margin of each segment, a large discal patch of slightly larger spines, and posterior transverse rows of still larger blunt ones. Between these patches and gradually merging into them are numerous smaller spines. Thus the entire surface is practically covered with microscopic spines of varying sizes, the anterior patches more distinctly separated from the remainder. The lateral fins of the eighth abdominal segment each has the usual four lateral filaments, and terminates in a slightly sinuous spur (fig.2). The caudal fin has the usual fringe of pale matted filaments.

Imago, male and female. Shining black; thorax of the male the same color, that of the female paler with three brown stripes. Antennae yellow, the antennal hairs of the male the same color; palpi yellowish; sternum schistaceous. Abdomen of the male slender, pilose, black, the first and second segments wholly, and the posterior margins of the third, fourth and fifth fuscous, the last three segments, widened and somewhat dilated; genitalia small, resembling those shown on pl.32, fig.8; the inferior lobes with curved setae; the superior lobes in this species are much shorter and without peduncle, pale in color; abdomen of the female stouter, black, paler at the base, pubescent. Wings white, with pale veins, spotless. Halteres white. Legs with the coxae pale yellow, or white, spotless, the middle and hind legs pale haired; the fore legs bare; the fore metatarsus over 1½ times as long as the tibia, and twice as long as the second tarsal joint. The thorax of the female is sometimes wholly brown. Length 3.5 mm. Translation in part from Zetterstedt, loc. cit.

A specimen from New Jersey is doubtfully referred to as this species by Johnson in Smith's catalogue of the insects of New Jersey. Several bred specimens from Ithaca, N. Y.

26. Chironomus chloris Meigen

1818 Chironomus. Syst. Beschr. 1:28, 17
1850 Chironomus Zett. Dipt. Scand. 9:3511, 27
1864 Chironomus Schiner. Fauna Austr. 2:604
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.256, 12

Length 5.5 to 7.5 mm. Head blackish, antennae and palpi dark brown; antennal hairs in the male brown; paler toward the tip. Thorax shining, blackish green, with black longitudinal stripes, the ground color usually so dark that the thorax appears wholly shining black, as do also the scutellum, metanotum, pectus and pleura; the pectus with light gray pruinose appearance. Abdomen olive green, black toward the caudal end; the anal segment of the male half as long as the preceding segment; the claspers small, slightly broadened at the middle; the hair of the abdomen grayish; after death the abdomen usually becomes wholly black. Legs brownish yellow; the femora, at least the knees, the tips of the tibiae and tarsal joints dark brown, the last tarsal joint wholly darkened; fore metatarsus 1.5 times as long as its tibia; fore tarsi of the male somewhat hairy but not bearded, the posterior legs of both sexes delicately ciliate. Halteres pale yellow, the knobs slightly darkened. The wings when held against the light appear brownish yellow, when held over a dark surface they appear whitish; the veins very pale brown; crossvein not darkened. Translation from V. d. Wulp. loc. cit.

The female has a yellow dorsum of thorax with three black stripes, the scutellum is yellow, and the abdomen sometimes has narrow whitish incisures.

According to V. d. Wulp (1868) this European species also occurs in the United States. Weyenbergh (1874, p.151) says that the larva is almost colorless, and is found upon weeds hanging into the water.

27. Chironomus devinctus Say

1829 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 6:150
1859 Chironomus Say. Compl. Wr. 2:349
1878 Chironomus Ost. Sack. Cat'l, Dipt. N. A. p.20

(Pl.28, fig.14)

Tergum black, incisures white; feet with black incisures; body dusky; stethidium dusky livid; thorax trilineate and blackish; scutel dull honey yellow, halteres and wings white; tergum brown-

ish black, incisures, particularly those near the base, white; thighs black, anterior (fore pair) pale at base; the others with a white annulus near the tip; tibiae and tarsi white, with black incisures. Length nearly 5 mm. Inhabits Indiana.

Some Ithaca specimens, both male and female, agreeing with above description may be more fully characterized as follows: The entire insect has the appearance of being black, and greatly resembles C. flavicingula Walker, differing in having white halteres and an unclouded crossvein. The thorax may be described as being wholly blackish with cinereous lines between the usual three black dorsal stripes; scutellum pale brownish. The narrow white posterior margins of the abdominal segments are very distinct and sharply defined. The fore metatarsus is more than 1¼ times as long as its tibia. My single male specimen has lost its fore tarsi. The wings are hyaline, all the veins, including the crossvein, pale. Ithaca, N. Y.

28. Chironomus californicus n. sp.

Male. Head yellowish brown, antennae with the hairs dull yellowish brown, large basal joint blackish; palpi dusky. Thorax opaque, bare, cinereous with three dull grayish or blackish dorsal vittae; humeri more or less yellowish; pleura and pectus gray or blackish; scutellum yellowish or pale brown; metanotum dull black. Abdomen linear, slender, gray haired, lusterless black, apical margin of each segment pale green or yellowish; the last three segments slightly wider, depressed. The genitalia fuscous, short and filiform. Wings white, the crossvein not darkened. The wing surface does not appear uniformly white, but the narrow space on each side of the veins is less purely white by reflected light. Halteres white. Legs white; the coxae grayish; the base and tip of each femur and of each tibia brownish or blackish; the tarsal joints somewhat infuscated. The middle and hind legs pale haired, the fore pair only pubescent; the fore metatarsus about two thirds longer than its tibia; the second tarsal joint about half as long as the metatarsus, the third and fourth but slightly shorter than the second. This species resembles C. niveipes Zett. but differs in the coloring of the legs. Length 5 to 6 mm. Pasadena, California.

29. Chironomus palliatus Coquillett

1902 Chironomus Coq. Proc. U. S. Nat. Mus. 25:95

Male and female. Head, mouth parts, and first joint of antennae dark brown, remainder of antennae livid, the hairs gray; thorax

dark brown, mesonotum opaque, a broad, yellowish median vitta on the anterior half, and a widely separated pair of gray pruinose vittae on the posterior half; abdomen opaque, velvet-black, its hairs yellow; legs yellowish white, front and middle femora, except their apices, also bases of hind femora brownish, middle tibiae tinged with brown, front tarsi only pubescent, front tibiae three fourths as long as their first tarsal joint, hind tibiae and their tarsi in the male densely clothed with rather long hairs; wings hyaline, slightly tinged with yellow, small crossvein not darker than the adjacent veins, third vein (R_{4+5}) almost straight; halteres whitish; length 2.5 to 4 mm. Washington, D. C. Coquillett, loc. cit.

30. Chironomus pedellus Degeer

1776 Tipula Deg. Mem. pour serv. a l'hist. d. Ins. 6:378, 17
1818 Chironomus Meigen. Syst. Beschr. 1:28, 16
1850 Chironomus Zett. Dipt. Scand. 9:3535, 57
1864 Chironomus Schiner. Fauna Austr. 2:606
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.259, 19
1794 Tipula cantans Fabr. Ent. Syst. 4:247, 67
1804 Chironomus Meigen. Klass. 1:13, 7
1805 Chironomus Fabr. Syst. Antl. p.45, 34
1803 Tipula littoralis Schrnk. Fauna Boica. 3:74, 2325
1880 Chironomus var. atricornis Strobl. Progr. Gymn. Seitenstetten. p.53

Male. Dorsum of the thorax shining black; the humeri with ferruginous or yellowish-green spots, which seem to be the remains of the original ground color; the scutellum and the metanotum also black. The abdomen a beautiful, bright green which becomes paler or more yellowish in dried specimens. The posterior segments flattened, black, or blackish-brown; the forceps quite small and slender. Head and palpi brownish; the antennae brown, its hairs lighter, the basal joint yellow. Legs pale yellowish, in life somewhat greenish; the coxae, the fore knees broadly, the middle and hind knees narrowly brown banded, the tips of the tibiae and the tips of the tarsal joints brownish; the femora and the tibiae of the fore legs of equal length; the fore metatarsus about one fourth longer than its tibiae, and not bearded. Wings whitish, with pale veins; venation as shown on pl.28, fig.16; the halteres pale.

Female. The female has yellow antennae with only black tips; and the humeral spots are more spread out, appearing to crowd the black dorsal patch into longitudinal stripes. Length 5.5 to 6 mm. Wisconsin (V. d. Wulp); New Jersey (Johnson). Several male specimens from Ithaca, N. Y.

31. Chironomus pedestris Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:246, 81
1850 Chironomus Zett. Dipt. Scand. 9:3537, 58
1864 Chironomus Schiner. Fauna Austr. 2:606

Resembles C. pedellus, but the extreme tips of the tibiae are black, the fore femora are entirely black with the exception of the base; and the tips of the knobs of the halteres are black. Length 5.5 to 6 mm. Schiner loc. cit.

Green, shining, thorax and tip of abdomen, black; dorsum of thorax of the male with three wide confluent black stripes; antennae of the male pale brown; wings white; tip of the knob of the halteres blackish; legs pale, the extreme tips of the tibiae, the whole of the fore femora except the yellowish bases are black; the anterior tarsi of the male nearly bare, fore metatarsus about one fourth longer than its tibiae; the male claspers short and slender. The first five abdominal segments in the dried specimens are pale yellow. Everything else as with C. pedellus Zetterstedt. New Jersey (Johnson).

32. Chironomus nigricans n. sp.

(Pl.21, figs. 5 to 12, and pl.28, fig.15)

Larva. The larvae were collected from the ponds in the vicinity of Cayuga lake, Ithaca, N. Y. They are blood-red, slender, about 12 mm. long, head short, pale brown, edge of the labium and tip of the mandibles black, each eye consisting of a pair of distinctly separated spots, one of these spots being again divided by a fine line. The antennae is slender, about three fourths as long as the mandible, its first joint five sevenths as long as the others taken together (fig.5). The labrum is of the usual form, with about five pairs of curved subapical setae, and a pair of flattened, ventrad-projecting fan-like processes. The epipharynx (fig.10) has a pair of curved, transverse, toothed ridges, a transverse comb (c) composed of five leaf-like parts, each part with four or five pointed lobes. The lateral arms, not shown in the figure, are of the usual form, each having a bilobed extremity, the outer lobe being slender and pointed, the inner one shorter and broader. The three pairs of pectinate setae which are placed within the horseshoe-shaped ridge are conspicuous (fig.10). The mandibles are stout, with black apices, the usual subapical hairs, mesad projecting branched setae, and a pair of slender lateral projecting setae (fig.7). The maxilla has a moderately stout palpus with a slender apical seta, several stout pale setae, some fine hairs near its base, several mesad projecting pointed lobes, and a number of scattered papillae

(fig.6). Upon the hypopharynx (hy) is a pair of slender branched processes besides the usual hairs and papillae. The middle pair of the teeth in labium (fig.6 l) are the longest, and the second, third and fifth laterals are longer than the first, fourth and sixth. The setae of the anterior prolegs are pale brown, and rather coarser and more distinct than those of most of the Chironomid larvae (fig.8). The posterior prolegs have the usual bilobed claws of which the two lobes of each marginal claw make a smaller angle with each other than do the central claws (fig.9). Immediately dorsad of the four short and thick anal blood gills is a pair of small setae; the basal nodule upon which each dorso-anal tuft of setae is placed is quite small, about as wide as it is long. The ventral blood gills of the eleventh abdominal segment were not seen in this specimen.

Pupa. (Figs. 11 and 12.) The pupa is greenish brown, about 6 mm. in length, with the usual pair of white thoracic respiratory tufts. The dorsum of the second and third abdominal segments are marked as shown in fig.11. Near the anterior margin of each of segments four, five and six is a transverse row of short but conspicuous dark spines. The epidermis at the base of each spine is brown; the entire dorsal surface of the segment behind this row is microscopically punctate with extremely short spines. Near the posterior margin these spines become somewhat larger, forming an irregular double or triple transverse row. Second segment is like the following segments, but has in addition the usual transverse row of longitudinal ridges on its posterior margin. All these segments have a few pale setae arranged as shown in the figure. The seventh and eighth segments are nearly devoid of markings, though they have a few small setae. The lateral fins of the eighth segment each has the usual lateral filaments, and each ends in a chitinous comb of five teeth (fig.12). The caudal fin has the usual fringe of matted hairs.

Imago. (Pl.28, fig.15.) Male and female, blackish; legs white, male with whitish abdomen. Length 4 to 5 mm.

Male. Head, including palpi, proboscis, antennae and its hairs pale fuscous. Dorsum of the thorax dark brown with three subshining broad blackish stripes, metanotum and pectus blackish; pleura and scutellum a little paler. The hairs of the mesothorax and scutellum yellow. Abdomen white with a greenish tinge, the last three joints including the genitalia sometimes pale fuscous, and occasionally the posterior margins of segments very narrowly darkened. The claspers elongate, the inferior lobes slender and slightly clubbed. Hairs pale. Legs white, the tips of the middle and hind tibiae each with a minute black circular comb with two of its teeth slightly elongated into spurs. Fore tarsi of male,

bare. Wings white with a slight milky tinge; veins colorless, including the crossvein; venation as figured. Halteres white, sometimes with a slight greenish tinge. In an occasional specimen the middle section of each fore femur is brownish.

Female. Like the male, excepting that the abdomen is black or deep fuscous, dull; in well-preserved specimens the posterior margins slightly cinereous; hairs pale. The flagella of the antennae and sometimes the palpi also yellowish. In both sexes the fore metatarsus is about one third longer than its tibia. One bred specimen and a number of captured ones from Ithaca, N. Y.; also some from New Jersey.

33. Chironomus aberrans n. sp.

Female. Resembles C. f a l l a x n. sp. but is paler. Length 3.5 mm. Head, including antennae, wholly yellow, palpi pale fuscous. Dorsum of the thorax and scutellum yellowish, the three dorsal stripes, pectus and a mark on the pleura, brownish; metanotum dark brown. Abdomen fuscous, the first two and the basal part of the third greenish or yellowish; posterior margins of the other segments indistinctly paler fuscous; hairs pale. Coxae, the knees, the tips of the middle and hind tibiae and of the tarsal joints brown; the apical half of front femora, basal half and the tips of the front tibiae, and the tips of the fore tarsal joints dark brown. Wings hyaline, with a milky tinge; the veins, including the crossvein, yellow; venation as shown on pl.28, fig.17. Halteres white. The fore metatarsus is about one fifth longer than its tibia.

Male. Like the female but differs in having the first four or five abdominal segments, yellowish. Ithaca, N. Y., Pennsylvania, Washington State, New Jersey.

34. Chironomus lugubris Williston

1896 C h i r o n o m u s Williston. Trans. Ent. Soc. Lond. p.274

Male. Similar to C. l o n g i m a n u s (No. 51), but differs in lacking the brown stripes of the mesonotum, which is uniformly light yellow, in the abdomen being uniformly brown, and in the femora being wholly light yellow. Length 3–4 mm. Williston, loc. cit. Fore metatarsus about 1¼ times as long as its tibia. St Vincent Island, West Indies.

35. Chironomus fumidus n. sp.

(Pl.28, fig.18)

Male. Fuscous; length 2.5 to 3 mm. Head with palpi, proboscis, and antennae pale fuscous; the basal joint of the last, brown, the second joint yellowish, the hairs pale fuscous. Dorsum

of thorax pale yellowish, pruinose, or with a greenish tinge, with three brown stripes; the scutellum yellow; the metanotum, sternum (and sometimes the pleura also) dark brown. Abdomen dark brown or black, subshining, sometimes the segments with a suggestion of a pruinose margin; hairs pale brown. Legs yellow, the knees and the tarsi somewhat infuscated; tips of the tibiae blackish. Legs hairy, including the fore tarsi; fore metatarsus nearly twice as long as the tibia, the second and third nearly subequal in length, the fourth but little shorter, the fifth shortest. Wings hyaline, sometimes slightly smoky, anterior veins yellow, the crossvein but little if any darker. Halteres pale yellow.

Female. The head with mouth parts and antennae (except the apical joints) more yellowish, thoracic stripes sometimes more reddish, and the abdomen a blackish green; anterior tarsi bare; in other respects like the male.

This species differs from C. halteralis Coq. in having pale halteres and the female having a blackish green abdomen. From C. longipes Staeger, an European species, it differs in having shorter tarsi. Ithaca, N. Y., July and August.

36. Chironomus tendens Fabricius

1794 Tipula Fabr. Ent. Syst. 4:243, 47
1805 Chironomus Fabr. Syst. Antl. p.39, 7
1818 Chironomus Meigen. Syst. Beschr. 1:34, 30
1850 Chironomus Zett. Dipt. Scand. 9:3525, 45
1864 Chironomus Schiner. Fauna Austr. 2:605
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.257, 15
1899 Chironomus Johnson, in Smith's Cat'l. of N. J. Ins. p.627

Dorsum of the thorax shining reddish yellow, with three wide ferruginous longitudinal stripes, which occupy nearly the whole of the dorsum; the median one abbreviated posteriorly, and only continued in an embossed yellow line to the scutellum; pectus, metanotum and scutellum ferruginous. Abdomen yellow or yellowish green; white-haired; the anterior ends of the segments and on the dorsum of the posterior segments somewhat darker; the forceps slender and strongly upcurved. Head yellow; antennae with the shaft brown, the basal joint and the hairs ferruginous; palpi brownish. Legs pale yellow, sometimes the tip of the tibiae and of the tarsal joints slightly darkened; fore tarsi of the male more or less thickly haired; metatarsus one fourth longer than the tibia. Wings whitish yellow; halteres yellow. The female is wholly shining ferruginous, with rather deeply yellow tinged wings. Length 6.5 to 7.5 mm. Schiner, loc. cit. New Jersey (Johnson).

37. Chironomus lineatus Say

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:14, 5
1859 Chironomus Say. Compl. Wr. 2:42, 5
1828 Chironomus lineola Wiedemann. Aussereurop. zweifl. Ins. 1:17, 6
1878 Chironomus Osten Sacken. Cat'l. Dipt. N. A. p.21
1899 Chironomus lineola Wied. Johnson in Smith's Cat'l. of Ins. N. J. p.626

Wings white; stethidium yellowish testaceous, a fuscous longitudinal line on the anterior dilated line.

Thorax pale greenish, the dilated lines yellowish testaceous, a longitudinal narrow line very distinct and fuscous on the anterior dilated line, and green rather obsolete behind; scutel pale; wings immaculate; feet whitish, incisures of the knees of the intermediate and posterior feet brown; tergum greenish, posterior margins of the incisures dusky. Length of the female nearly three tenths of an inch (7.5 mm.). Pennsylvania. Say, loc. cit. New Jersey (Johnson).

38. Chironomus albipennis Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:248, 87
1850 Chironomus Zett. Dipt. Scand. 9:3526, 46
1864 Chironomus Schiner. Fauna Austr. 2:608
1877 Chironomus V. d. Wulp. Dipt. Neerl. 257, 14
1899 Chironomus Johnson, in Smith's Catalogue of Ins. of N. J. p.627

Shining ferruginous; thorax with three chestnut longitudinal stripes; a spot on each pleuron and the metanotum more or less brown; the scutellum yellow. The abdomen green, in dried specimens brownish above, the anal segments flattened, the forceps short and sublanceolate, the arms incurved, and hairy. Palpi and antennae brown, the hairs of the latter lighter at the tip. Legs pale yellow, the tarsal joints usually darkened; sometimes the extreme tips of the tibiae are also darkened; fore tarsus of the male delicately but distinctly haired, its metatarsus an eighth longer or at least as long as its tibia. Wings white, the costal veins of the female ferruginous, the crossvein not darkened. Halteres pale. Length 5 to 6 mm. A specimen from New Jersey is doubtfully identified as this species by Johnson (1899).

I have a purchased specimen, collector unknown, bearing the label C. albipennis, Riverton, N. J., but which in reality is not albipennis, but is C. nigricans n. sp.

39. Chironomus taenionotus Say

1829 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 6:149
1859 Chironomus Say. Compl. Wr. 2:349
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Female. Stethidium green trilineate; a black line on the middle of the anterior line. Body bright pea-green; head yellowish, terminal joint of the antennae blackish; thorax with three dilated, pale honey yellow vittae; a black line along the middle of the anterior one; wings white; metathorax pale honey yellow; with a blackish spot in the middle, divided by a green line; tergum immaculate; pectus pale honey yellow; feet pale greenish, anterior tibiae and tarsal incisures dusky. Length more than one fifth inch (=5mm.). Indiana. Say, loc. cit.

40. Chironomus fulvus n. sp.

Larvae collected in Beebe lake near the shore in August; reddish yellow in color. Length about 5 mm. The empty larval skin was subsequently lost, hence no further description can be given.

Pupa. A single pupa from which emerged a specimen so greatly resembling the species described below that I believe them to be identical. This pupa had very much elongated respiratory organs; nearly as long as the body, the main trunk flattened, slender, diminishing in diameter toward the end, the apical end subdividing into three or four branches. Each abdominal segment with a transverse row of rather conspicuous spines near the posterior margin, and a number of long setae, three or four pairs of which are laterals, one or two pairs discal, and a marginal pair, all as shown on pl.22, fig.20. The lateral fin of the eighth segment is provided with a somewhat sinuous yellow spur a little caudad of the middle. The caudal fin is fringed with the usual flattened matted filaments, those more caudad being longer and broader than the others (pl.22, fig.23).

Imago. (Pl.28, fig.19). Deep yellow; wings hyaline, yellow tinted. Length 3 to 4 mm.

Female. Head yellowish, occiput dusky, palpi, antennae and proboscis subfuscous; the base of the second joint and sometimes the basal joint and some of the intermediate joints of the antenna yellowish. Dorsum of the thorax pale yellow, with a whitish sheen, with three testaceous stripes, the middle one divided by a fine line. Humeri whitish, scutellum and part of the pleura yellow, the remaining parts of the thorax reddish yellow. Abdomen reddish yellow, the more posterior segments brownish, the posterior margins of the segments a very little, if any, paler; hairs yellow. Coxae and legs yellow, the fore legs excepting the middle section of the femora, and the whole of the middle and hind tarsi excepting the basal half of the metatarsi, fuscous. Tips of middle and hind tibiae with minute black comb. Wings hyaline, with a slight yellow or dusky tint; anterior veins including the crossvein yellow; venation as figured. Halteres pale yel-

lowish, sometimes with a slight greenish tint. In immature specimens the parts described above as dusky are more yellowish. The fore metatarsus is about three fourths longer than the tibia. Numerous female specimens. One bred specimen believed to be the same, the pupa of which is described above. Ithaca, N. Y.

41. Chironomus flavus n. sp.

(Pl.22, figs. 1 to 4; pl.28, fig.20; pl.32, fig.12)

Larva. No eggs were found. The larvae were taken in company with Thalassomyia fusca from the surface of the rocks washed by swift flowing water. Some specimens of the larvae found in August were placed in still water, and in due time transformed and emerged, so that it appears that this species will live in still water also. The full grown larva is pale yellowish green, with pale brown head. Length 6 to 7 mm. and quite slender. The head is rather short, pale brown, the eye spots each consist of a pair of contiguous spots, conspicuously black, and the black ends of the mandibles show prominently. There are several setae upon the head, one in front, one close to but mesad of the eye and a pair on top of the head between the eyes; besides these there is a transverse row of about 6 setae a little distance back of the eyes. The antennae (pl.22, fig.1a) are slender, about the length of the mandibles; the first joint is about three fifths of the whole length, the white apical process of the first joint is nearly as long as the four apical joints taken together. The two apical processes of the second joint are about as long as the third joint. The labrum has about six pairs of rather prominent pale setae, some of them pectinate, and a pair of short pale fan-like processes at the apex. The mandibles (fig.1 md) are stout and have a densely black tip; the maxilla (fig.1 mx) has a prominent palpus, a pair of exceedingly delicate slender mesad projecting processes with several setae. The epipharynx has the usual pair of lateral arms, a transverse comb composed of three hand-like processes, and the curved pectinate hairs. The hypopharynx (fig.1 hy) has the usual papillae. The labium has a conspicuous black margin with the two middle teeth longest, the first laterals much smaller, the second laterals larger than the first, those laterad gradually decreasing in size outwards. The anterior prolegs have numerous curved hairs, the posterior pair (fig.2) with numerous prominent bilobed hooks. The ninth abdominal segment (fig.2) has the normal dorsal tufts of setae, four pale blood gills, of which the apical two thirds of each is considerably smaller in diameter and pointed at the apex. Dorsad of the upper pair is a pair of rather prominent setae.

Pupa. Pale yellow, with yellowish brown thorax; length 3.5 to 4 mm. Thoracic respiratory tracheae are delicate, much branched, and white in color. The second and third abdominal segments (fig.3) each are marked with an anterior transverse row of caudad projecting short setae, the disk more or less covered with smaller and more delicate ones, leaving a number of round clear spaces. The fourth and fifth are like the third, the following ones with fewer setae. The first is bare, the second has besides those mentioned the usual transverse row of black, longitudinal ridges. The anterior lateral margin of the anterior segments is marked with a pale brown cloud, most easily seen in the empty pupal skin. The lateral fin of the eighth abdominal segment has the usual filaments, each fin terminating in a toothed process, deep brown in color (fig.4). The caudal fin has the usual fringe of matted hairs.

Imago, male. Yellow; length 2 to 2½ mm. Head with proboscis, palpi, and basal joint of antenna yellow; antennal flagella and sometimes tip of proboscis pale fuscous. Thorax with all its parts pale yellow, the dorsum with three deeper yellow stripes. In some specimens the metanotum, parts of the pleura and the pectus somewhat deeper yellow. Abdomen wholly pale yellow, with whitish hairs; in living specimens the abdomen is sometimes pale yellowish green; genitalia (pl.32, fig.12) long and slender and yellow in color; the claspers long, the superior lobes blunt with curved spines, the inferior lobes very slender and with an elongate apical seta each. Legs wholly pale yellow, and excepting the first pair rather hairy. Tips of the tibiae with the usual minute black combs. The fore femur is about one third longer than its tibia, and the fore metatarsus is about 1¾ as long. Wings hyaline, with a slight milky tinge, veins colorless; venation as shown on pl.28, fig.20. Halteres white.

Female. Like the male, but the antennae are yellow, apical joints are fuscous. The abdomen has a faint suggestion of white margins on the segments. In some specimens the dorsal stripes are quite indistinct; in living specimens the thorax is sometimes a greenish yellow and the abdomen bright green. This species must not be confused with Tanytarsus exiguus which it closely resembles, but from which it may be distinguished by its distinct radial veins and hairless wings. Ithaca, N. Y.

42. Chironomus brevitibialis Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3537, 59
1864 Chironomus Schiner. Fauna Austr. 2:606
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.261, 22
1898 Chironomus Lundb. Videnskab, Meddel. p.273, 51

This pale green species resembles C. viridis, but is smaller; the thoracic stripes, the sternum and the metanotum pale ferruginous, sometimes subobsolete; the claspers of the male quite long and slender; the legs pale yellow or white; the femora sometimes slightly greenish; the extreme tip of the tibiae and of the metatarsi and the whole of the last tarsal joints brownish. Well-colored specimens, with distinct ferruginous thoracic stripes, have the legs more greenish, and the fore legs brownish. The fore tibia is one third shorter than the femur and the fore metatarsus nearly twice as long as its tibia; the remaining tarsal joints are much shorter; fore tarsi are bare; the hind legs are hairy. Halteres and wings white. Length 3.5 to 4.5 mm. Translation from V. d. Wulp. Greenland (Lundbeck); Washington State; Long Island, N. Y.

43. Chironomus modestus Say

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:13, 3
1828 Chironomus Wied. Aussereurop. zweifl. 1:18, 8
1859 Chironomus Say. Compl. Wr. 2:41, 3
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Larva. (Pl.22, figs.8 to 12). The larva is buff-colored or yellow, with a slight reddish tinge; length 6 to 7 mm. The head is brown with a few dorsal setae; antennae (fig.9) slender, as long as the mandibles, basal joint three fifths of the whole length. The labrum (fig.10 ulr) with a few prominent pale setae, several hairs of which are pectinate. The epipharynx with the usual pectinate setae, lateral arms and transverse comb, the last with but five blunt rounded teeth. Mandibles (fig.11) with blackened teeth. Maxillae (fig.11 mx) with short palpus, several setae and a small group of mesad projecting slender lobes. Labium (fig.11 l) with rounded margin, the teeth with rounded outline, and a pair of ventral setae. Posterior prolegs with bilobed claws, anal blood gills distinct; the posterior dorsal tufts of setae are each placed upon a papilla which is about as broad as long, and which has a very delicate seta on its side.

Pupa. Pale green, length 5 to 5.5 mm. Respiratory organs consist of a pair of tufts of white filaments. Dorsal surface of the fourth abdominal segment (fig.12) marked with two transversely oval patches of microscopic setae near the anterior margin and a large patch with few clear spaces covering the greater portion of the dorsum; this patch is widest at the posterior margin. The third, fifth and sixth segments are similarly marked, but the patches are smaller on the fifth and sixth, and larger on the third; the seventh and eighth are usually bare; the second has the usual transverse row of longitudinal ridges on its posterior margin, and the dorsal surface is marked like that of the

third, though the setae near the posterior margin appear a little more prominent. Near the posterior ventral margin of the first, the anterior and posterior ventral margins of the second, and sometimes on the anterior margin of the third also there is a row of rather long, slender, conspicuous, pale setae. Each lateral fin of the eighth segment has the usual set of four pale filaments and a brownish yellow slightly sinuous tooth (fig.8). The caudal fin has the usual fringe of filaments. The dorsal surface of the first, second and third segments is frequently slightly gray clouded.

The larva and pupa of this species have also been described by Dr Dyar (1902, p.57) from Bellport, N. Y.

Imago, male. Stethidium yellowish, abdomen pea green. Eyes black; antennae, shaft brown, whitish at the base; humerus, scutel and intervals between the dilated lines of the thorax pale; wings immaculate, costal edge near the tip somewhat dusky; feet greenish white, anterior tibia and the tarsi dusky. Length one fifth of an inch (=5 mm.). Pennsylvania (Say); New Jersey (Johnson); Ithaca, N. Y.

To Say's description, given above, may be added the following: The female is like the male, but the antennae are more yellowish and the abdomen more deeply green. The fore tarsi of the male are nearly bare; the fore femur is about one third longer than the tibia, while the metatarsus is about five sixths longer. The male genitalia are figured on pl.32, fig.8, those of the female in fig.11.

There appear to be several varieties of this species, differing slightly in the adult state, and more distinctly in larval and pupal stage. It is possible that when these and closely allied species are better known, my varieties will be considered distinct species.

Var. a. Larva reddish. The fourth abdominal segment of the pupa as shown on pl.22, fig.15; the lateral fin of the eighth segment with comb of several teeth (pl.22, fig.16). The imago differs principally in being smaller, in length not exceeding 3 mm., while the smallest specimens of the typical variety are over 3.5 mm. in length. In color, too, they are more deeply green, including the thorax and legs. The wing venation is as shown on pl.29, figs.1 and 2.

Var. b. The pupa differs from those of the preceding varieties principally in being devoid of spurs at the end of the lateral fin of the eighth segment. The dorsal surface of segments 5 to 9 is marked as shown on pl.22, fig.14. The imago is about 3 mm. in

length; the longitudinal stripes of the thorax rather faint; the male genitalia as shown on pl.32, fig.9; the lateral arms prolonged, curved upwards and enlarged at the ends; the inferior lobes slender, about one half as long as the outer pair, with a slight enlargement at the end; the superior arms are still shorter and curved; the dorsal keel is elongate, curved downwards, and with a slight notch near the tip. Both of these varieties from Ithaca, N. Y.

44. Chironomus fulviventris n. sp.

Larva. Slender, head brown, tip of the mandible and edge of the labium black; each eye consists of two distinct spots. Antennae short, stout, basal joint four sevenths of total length; the appendage at the apex of the first joint longer than the four apical joints. Labrum and epipharynx resembles that of decorus n. sp., the transverse comb like that shown on pl.22, fig.19; the lateral arms prominent and uniformly brown. Mandibles and maxillae normal; the labium has the middle pair of teeth shorter than the first and second laterals (pl.22, fig.24). The ventral blood gills were not discovered; the four anal gills longer than the anal prolegs; the other appendages normal.

Pupa. The pupa has the dorsal surface of the abdomen marked like that shown on pl.21, fig.11; the terminal spines of the lateral fins of the eighth segment are shown on pl.22, fig.26. The caudal fin has the usual fringe of matted hairs.

Imago. Male, deep yellow; length, 3 to 4 mm. Head yellowish, palpi, proboscis and antennae pale fuscous, the basal joint of the last yellow, its hairs yellowish brown. Dorsum of thorax yellowish with 3 wide testaceous stripes, the middle one divided by a fine line; mesonotum and pectus reddish brown; scutellum and pleura yellowish, the latter with some blotches, reddish brown. Abdomen brownish, the anterior and posterior margins of each segment yellowish. Last 3 segments broadened, all hairs yellowish brown. The genitalia have a pair of elongate lateral arms, a pair of blunt clubbed inferior lobes with curved setae, a pair of hook-like superior lobes and a downward curved keel (one half of these parts are as shown on pl.32, fig.10). The coxae, the femora, particularly the apical half, the basal half of the fore tibiae and the immediate bases of the middle and hind tibiae, the tips of all tibiae, and all tarsal joints yellowish brown; the remaining parts more yellowish or whitish; all hairs pale, fore tarsi bare. The wings hyaline, all the veins pale. Halteres white.

Female. Like the male, but the abdomen is nearly uniformly yellow. In both sexes the fore metatarsus is only about one eighth longer than its tibia. Specimens of larva, pupa and adult, from Saranac Inn, N. Y.; several adults from Ithaca, N. Y.

45. Chironomus pallidus n. sp.

(Pl.29, fig.5)

Male. The thorax yellow; abdomen whitish; length 4 to 4.5 mm. Head yellow, including two basal joints of antennae; proboscis and palpi fuscous or subfuscous; the flagellum of the antenna dusky yellow. Thorax ferruginous, the scutellum, the humeri, space in front of the scutellum and between the ferruginous dorsal stripes is yellowish or whitish; metathorax testaceous, brown or sometimes blackish. Abdomen white; yellowish or pale greenish toward the tip. Genitalia white. Legs white, tip of fore femur, base and tip of fore tibia, blackish; extreme tips of middle and hind tibiae each with a minute black comb; the knees of middle and hind legs sometimes slightly infuscated. Fore metatarsus about one quarter longer than its tibia; fore legs nearly bare, middle and hind ones rather hairy. Wings hyaline, veins nearly colorless. Halteres white.

Female. Antennae yellow with apical joint fuscous. Abdomen pale greenish. Ithaca, N. Y. July and September.

46. Chironomus frequens n. sp.

(Pl.29, fig.7)

Differs from brevitibialis (No. 42) in that the fore metatarsus is only one third longer than its tibia, the tibia more than three quarters as long as its femora. The face and palpi are yellowish in some specimens. The apical one third of the fore tibia and of the metatarsus, the third fore tarsal joint, the whole of the fourth and fifth joints of all the feet, and the tips of all the other tarsal joints, blackish. The tips of the second and third tibiae each with a minute black comb. The paler portion of tibia and metatarsus is white. In other respects the two descriptions correspond. Length 3.5 to 4 mm. Many female specimens. Ithaca, N. Y.

47. Chironomus viridis Macquart.

1834 Chironomus Macq. Suit. à Buffon. 1:52, 21
1838 Chironomus Meig. Syst. Beschr. 7:6, 127
1850 Chironomus Zett. Dipt. Scand. 9:3531, 53
1864 Chironomus Schiner. Fauna Austr. 2:605
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.258, 17
1895 Chironomus Johnson. Proc. Acad. Nat. Sc. Phil. p.320
1767 Tipula? virens Linn. Syst. Nat. ed. XII. 2:975, 34
1838 Chironomus vulneratus Zett. Ins. Lappon. p.814, 28

Male. Dorsum of the thorax greenish yellow, with three ferruginous longitudinal stripes as with C. tendens. The sternum, a spot on the pleura and the metanotum ferruginous. Abdomen a beautiful light green; on the dorsum, particularly

toward the posterior end, somewhat darker; the posterior segments somewhat flattened; the forceps moderately long and strong. Head yellowish, palpi brown, antennae brown, with its hairs lighter, the basal joint yellow. Legs pale yellow; the extreme tip of each tibia brown; the tarsi toward the end somewhat darker; the foremost pair delicately haired, but not bearded; the fore metatarsus one third longer than its tibia; occasionally the fore tibiae and tarsi darkened; the femora, however, are usually somewhat greenish. The fore femora and fore tibiae are of about equal length. Wings whitish, with pale veins.

Female. The antennae are yellow and have brown tips. Length, 5.5 to 6.25 mm. Translation from Schiner loc. cit. Florida (Johnson).

48. Chironomus dux n. sp.

(Pl.29, fig.8)

Larva. The blood-red larva resembles in structural detail that of C. modestus (pl.22, figs. 9 to 11). The labium differs in having the second lateral tooth smaller than the third; somewhat resembling fig.1 on pl.21, but the second lateral is more distinctly separated from the first.

Pupa. The pupa has the dorsal surface of the fourth, fifth and sixth abdominal segments marked somewhat like that shown on pl.22, fig.15. The second and third segments are more widely covered with microscopic setae, leaving here and there small, circular, bare spots. The terminal comb of the lateral fin of the eighth segment resembles that shown on pl.22, fig.16, but the comb stands out more nearly at right angles with the long axis of the body, and the teeth are somewhat curved caudad.

Imago, male. Length 5 to 6 mm. Bright green. Head and proboscis and basal joints of palpi pale green, the apical joints of palpi slightly infuscated. Basal joint of antenna yellow, the flagellum fuscous, the hairs brownish. Dorsum of thorax with its three stripes, the metathorax, the sternum and a few spots on the pleura buff-colored; the humeri, space between the dorsal stripes, space in front of the scutellum, the scutellum and the pleura, green. Abdomen green with pale hairs. Genitalia yellow. Coxae and femora green, middle and hind tibiae greenish or yellowish, fore tibiae yellowish, slightly infuscated. Tarsi fuscous, the metatarsi slightly paler. Middle and hind legs rather hairy; fore legs nearly bare. Fore metatarsus about one third longer than its tibia; wings hyaline, the anterior veins yellow, the crossveins the same color; venation as figured. Halteres green.

Female. Slightly darker than the male. Dorsal stripe of the thorax more brownish, tibiae slightly infuscated, especially the front pair; and the extreme tips of the femora also show a trace of brown. Ithaca, N. Y.

49. Chironomus viridicollis V. d. Wulp

1858 Chironomus V. d. Wulp. Tijds. v. Ent. 2:161, 2
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.254, 9
1898 Chironomus Johnson, in Smith's Cat'l. of Ins. N. J. p.627

Male and female. Thorax green, shining, black, striped; abdomen fuscous; legs yellowish green, the knees and the fore tibiae black; the fore tarsi of the male bare, male anal appendages small and slender. Length 6.75 to 9 mm.

Antennae and palpi dark brown, the antennal hairs of the male yellowish gray. Thorax shining, bright green; the dorsal stripes (of which the middle one is divided by a fine line), two or three spots at the root of the wing, the sternum, and the metanotum, brownish black. Abdomen shining, blackish, with yellow hairs; the posterior margins of the segments appear light gray, and a longitudinal dorsal stripe sometimes becomes visible. The last abdominal segment of the male is not as long as the preceding, its appendages are filiform, pointed, not longer than the eighth segment. Legs greenish yellow; the tip of the fore femur, the entire fore tibia, the knees of the last pair of legs, the tips of the tibiae of the last pair of legs, the tips of the first two joints of all the tarsi, and the whole of the last tarsal joint of all the legs, brownish black. The fore metatarsus is about 1½ times as long as its tibia, the next tarsal joint is one half as long as the metatarsus, the third and fourth are still shorter, and of about equal length, the fifth is the shortest. The fore tarsi of the male are not hairy. The last pair of femora and tibiae are pale haired. Halteres with a pale peduncle and a greenish head. Wings almost hyaline, the costal margin with a brownish tint, the veins brownish, the anterior ones darker; the crossvein somewhat darkened. Translation from V. d. Wulp, loc. cit.

Reported by Johnson from New Jersey. A number of specimens from Ithaca N. Y., cannot be distinguished from the European species. The wing venation is as shown on pl.29, fig.9.

50. Chironomus jucundus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:16
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Male. Wings bare; chest red, with a broad black stripe on each side; scutcheon black; abdomen yellow, hairy; hind borders of the segments and the whole of the latter segments, black; feelers tawny, and adorned with tawny hairs; legs pale yellow, hairy; tips of shanks brown; wings white; veins pale yellow; poisers white. Length of body, 2½ lines (5 mm.); of the wings, 4 lines (8 mm.). Georgia. Walker, loc. cit. New Jersey (Johnson, 1899).

51. Chironomus longimanus Williston

(Pl.29, fig.10)

1896 Chironomus Will. Trans. Ent. Soc. Lond. p.274, 3

Male. Head yellow. Antennae, save the basal joint, black or deep brown, the plumosity grayish black. Thorax light yellow; a blackish brown stripe, running from in front of the root of each wing, and joining in the middle in front, forming a V-shaped figure; below these stripes the sides of the mesonotum are of a purer yellow; the metanotum and a spot below the halteres blackish. Abdomen yellow; a black band on the posterior margin of the first and second segments; the fourth segment, the posterior, or greater part of the fifth segment, and the hypopygium, black or dark brown. Legs yellow; the base and tip of the four posterior femora, and the proximal end of their tibiae brown; front legs much elongate, the metatarsi about one fourth longer than their tibiae. Wings nearly hyaline. Legs, 3 to 4 mm. Williston, loc. cit. St. Vincent Island, West Indies.

52. Chironomus lobiferus Say

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:12, 1
1859 Chironomus Say. Compl. Wr. 2:41, 1
1828 Chironomus lobifer Wied. Aussereurop. zweifl. 1:16, 4
1878 Chironomus Ost. Sacken. Cat'l. Dipt. N. A. p.21

Larva. Blood red; length 14 to 15 mm. Head dark brown, each eye consists of two distinctly separated spots; the antennae are about three fifths as long as the mandibles, brownish in color, the basal joint about five ninths of the whole length, the remaining joints slender (pl.23, fig.2). The mandibles, labrum, and epipharynx resembling those of C. decorus. The setae of the epipharynx pectinate. The teeth of the transverse comb as large as in C. decorus but not all are of the same length. The maxilla and the labium are as shown on pl.23, fig.3; the toothed margin of the latter being deep black. The setae of the anterior pair of legs are curved and hair-like. The anal prolegs have the usual bilobed claws; the four anal blood gills are short, about three times as long as wide; the caudal setae are as usual.

Pupa. The pupa has plumose respiratory filaments; the markings of the dorsum of the abdominal segments consists of a uniformly distributed area of miscroscopic spines. The lateral fins of the eighth segment (pl.23, fig.5) has the usual lateral filaments, and each terminates in a very small comb of about seven teeth. The caudal fin bears the usual fringe of matted filaments.

Imago. Antennae yellowish brown; thorax pale cinereous, the three lines testaceous; scutel and metathorax testaceous; wings white, with a brownish obsolete point near the middle; pectus testaceous; feet pale yellowish, tergum somewhat glaucous, the

segments with their bases and an obsolete longitudinal line black; on the middle of the base of the second, third, fourth and fifth segments is a small, longitudinally oval, slightly elevated lobe, extending nearly one-third the length of the segment. Length three tenths (=7.5 mm.). Inhabits the United States. Say, loc. cit.

The larvae and pupae were collected by Mr C. S. Banks at Albany N. Y. The imago was not bred, but from nearly mature pupae it was determined that on the dorsal surface of the posterior margin of each abdominal segment excepting the last is attached a spiked mace-like appendage (pl.23, fig.4) which extends one third the length of the segment following. On the anterior segments this lobe is somewhat smaller and shorter. As it lies closely applied to the dorsal surface of the segment it appears as if it were a nodule of that segment rather than a process from the segment preceding. The imaginal colors could be distinctly seen through the pupal skin, agreeing with the description given above.

53. Chironomus festivus Say

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:13, 2
1828 Chironomus Wied. Aussereurop. Zweifl. Ins. 1:16, 5
1859 Chironomus Say. Compl. Wr. 2, 41
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Body pale, when recent, light green; pectus, three thoracic lines and scutel testaceous; wings white. Body pale yellowish brown, when recent, pale green; head at base of the antennae testaceous; antennae light brown; eyes deep black; thorax trilineate with testaceous, scutel testaceous; wings white, immaculate; pectus testaceous between the two anterior pairs of feet; feet pale, hairy; thighs green; tarsi dusky at the incisures; anteriors nearly naked, with hairy tarsi; abdomen, second, third, fourth and fifth segments tipped with blackish above. Length of female 7/20 of an inch (9 mm.). Observed particularly in Illinois. Say, loc. cit.

Wiedemann describes both male and female, but gives the length as 6.5 mm. A male specimen bearing the label C. lineola Wied., Westville, N. J., agrees with the above description of festivus, and I believe it to be the latter. In this specimen the fore metatarsus is about 1.4 times as long as its tibia, and the fore tarsi are provided with long hairs. This species seems to be closely related to C. tendens

54. Chironomus willistoni nom. nov.

1896 Chironomus sp. Will. Trans. Ent. Soc. Lond. p.275, 6

Male. Light yellow, the antennae brownish, and, rarely, the posterior part of the abdomen also brownish. Extreme tip of the four posterior tibiae black; front metatarsi about one fourth longer than their tibiae. Wings hyaline; anal angle only feebly indicated. Length 2 to 2.5 mm. Williston, loc. cit. St Vincent Island, West Indies.

55. Chironomus anonymus Williston

1896 Chironomus Will. Trans. Ent. Soc. Lond. p.274, 2

The larvae are described by Dr H. G. Dyar (1902). They are bright red in color, and possess the four ventral blood gills of the eighth segment. The mouth parts are not described. The pupa is of the usual type. Both larvae and pupae were found in a rain-water barrel at Bellport, N. Y.

Imago, male. Head red, or reddish yellow, the front more yellow. Antennae brown, first joint red; plumosity at the tip blackish. Mesonotum light brownish red; two stripes and the humeri yellow; scutellum light yellow. Pleura light brownish or reddish yellow. Metanotum brown. Abdomen blackish, the first segment and the distal part of the next two or three segments yellow or yellowish. Legs yellow; the immediate tip of the tibiae and the tip of all the tarsal joints dark brown; proximal end of the front tibiae also brown; front tibiae about one half the length of their metatarsi, and not longer than the second joint. Wings nearly hyaline. Length 4 to 5 mm. Williston, loc. cit. St Vincent Island, West Indies.

A male specimen from Illinois differs from a St Vincent co-type specimen in being paler, in having the thoracic stripes, pleura, metanotum and sternum pale reddish yellow or buff colored, the remaining parts greenish yellow, the abdomen as described, the paler parts with a greenish tinge.

56. Chironomus innocuus Williston

1896 Chironomus Will. Trans. Ent. Soc. Lond. p.274, 5

Male. Head and basal joints of the antennae light yellowish; palpi brown; antennae brown. Thorax light yellow; mesonotum with a brown stripe in the middle in front, and, on either side, an oval brown spot, the three separated, and the middle stripe bisected by a slender yellow line. Scutellum light yellow. Metanotum brown; halteres brown. Abdomen black, with black hair;

the seventh and eighth segments light yellow, with yellow hair. Legs light yellow; the extreme tips of the four posterior tibiae black; distal joints of the front tarsi infuscated, as also the front tibiae; front metatarsi about one third longer than their tibiae. Wings hyaline. Length 3 to 4 mm. Williston, loc. cit. St Vincent Island.

57. Chironomus similis n. sp.

(Pl.29, fig.13)

Resembles C. cristatus Wied.; differs in being smaller and in having proportionately longer fore metatarsi. Length 3 to 4 mm.

Male and female. Head brownish, palpi and antennae including basal joint dark brown, antennal hairs of the male yellowish brown. Thorax dusky yellow, the three dorsal stripes and sternum brown, scutellum yellow, metanotum blackish. Abdomen brown, posterior margins of the anterior segments widely yellowish, with cinereous bloom; anterior margins narrowly yellowish, the brown marking prolonged caudad along the middle line; posterior segments almost wholly brown with cinereous bloom. Legs yellow or yellowish brown, knees and tarsi sometimes a little darker. Fore metatarsus three fourths longer than the tibia; fore tarsi nearly bare; middle and hind legs hairy. Wings hyaline, veins yellow, crossvein brown though not very prominent. Halteres yellow. Chicago, Ill., Brookings, S. D., and Ithaca, N. Y.

58. Chironomus redeuns Walker

1856 Chironomus Walker. Ins. Saunders, I. Dipt. p.422
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21
1900 Chironomus Coq. Proc. U. S. Nat. Mus. 22:250

Female. Wings bare. Tawny. Antennae brown, tawny at the base. Thorax with four brown stripes, the outer pair paler, broader and shorter than the inner pair. Abdomen brown, with a hoary band on the hind border of each segment; under side tawny. Legs testaceous; tips of the femora, of the tibiae and of the joints of the tarsi brown. Wings limpid; veins brown, strongly defined; discal mark distinct. Halteres testaceous. Length of the body 3 lines (=6 mm.); of the wings 5 lines (=10 mm.). United States. Walker, loc. cit. Puerto Rico and Mississippi (Coquillett, loc. cit.).

59. Chironomus plumosus Linne

1758 Tipula. Syst. Nat. ed. X. p.587, 19
1761 Tipula. Fauna Suec. ed. II. p.434, 1758
1767 Tipula. Syst. Nat. ed. XII. 2:974, 26

1804 Chironomus Meigen. Klass. 1:11, 1
1818 Chironomus Meigen. Syst. Beschr. 1:20, 1
1850 Chironomus Zett. Dipt. Scand. 9:3481, 1
1864 Chironomus Schiner. Fauna Austr. 2:601
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.249, 1
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21
1805 Chironomus annularis Latr. Hist. Nat. d. Crust. et d. Ins. 14:289, 1
1818 Chironomus grandis Meigen. Syst. Beschr. 1:21, 2 (Pl.29, fig.11)

The larva and pupa were obtained from the swamps in the vicinity of Cayuga lake, Ithaca, N. Y. No adults were reared, although several were captured in the neighborhood. The extremely large size of the larva and pupa, together with the coloring of the latter, lead me to believe that my specimens are the early stages of C. plumosus. In fact the only species which has been taken here in a number of seasons collecting which is large enough to have larva and pupa of this size is plumosus, and I therefore shall tentatively so consider it.

Larva. Blood red, length of body about 22 mm. Head brown, antenna short and stout, basal joint about half as long as the mandible; the latter with blackened teeth and with the usual mesad projecting setae. Labrum, epipharynx and hypopharynx were destroyed. Maxilla with short palpus and a mesad projecting lobe with setae and papillae as shown in fig.16 of pl.23. Labium (pl.23, fig.15) broad with short blunt teeth; the middle tooth broad with a nearly straight apical margin, the first lateral small and more or less rounded, the second lateral broad and a little longer than the middle one; the third pair smaller and closely united with the second; fourth, sixth and seventh laterals about of equal size with rounded margins, the fifth slightly smaller. Anterior prolegs with very numerous fine hair-like setae. Ventral and anal blood gills present. The larva (4) mentioned by Garman (1888) is probably this species.

Pupa. Grayish brown in color; the markings of the enclosed imago visible; length about 16 mm. Respiratory filaments much branched and whitish in color. The dorsum of the abdominal segments uniformly covered with microscopic spines, those nearest to the posterior margins of the segments a little stouter than the others. The lateral fin of the eighth segment terminates in a chitinous process or spur, the extremity of which is divided into 7 or 8 spines in close contact (pl.23, fig.14). Caudal fin with the usual fringe of matted filaments. The mutilated condition of the larva and pupa renders further description impossible.

Imago, male and female. Dorsum of the thorax dull pale yellow, with three blackish gray, wide, longitudinal stripes, middle one posteriorly, the lateral ones anteriorly abbreviated; in front of the scutellum with a shining whitish gray spot; pleura near the coxae darkened, with grayish sheen; metanotum gray. Abdomen pale yellowish, each segment with a broad brown spot, which often widens into cross bands, the last few segments and the sides of the others in certain lights with whitish gray sheen, the hairs pale yellow; the last few segments flattened, the anal one with its incisure deep, the forceps brownish yellow, slender. Head yellowish; antennae brown, the hair is light brown; palpi ferruginous, often quite dark. Legs yellow, the knees darkened, the other articulations, narrow blackish brown; fore tarsi of the male with long hairs; metatarsus one fourth longer than the tibia; middle and hind legs delicately but long and thickly haired. Wings whitish with a black spot. The female quite robust, colors darker, abdomen brown, with gray reflections, the incisures appearing at most slightly whitish, the antennae yellow, at the end brownish. The coloring of this species is variable, sometimes lighter, sometimes darker, occasionally it has a touch of ferruginous, which is then particularly noticeable on the antennal hairs; on the whitish-gray posterior segments of the abdomen often appear regularly arranged brown markings. The metamorphosis of this species was first described by Reaumur. Length, 11 to 12 mm. Schiner, loc. cit.

Brought from Mackenzie river by R. Kennicott (Ost.-Sack., loc. cit.). Reported from Chautauqua lake N. Y., by C. V. Riley (1886). Some male and female specimens from Ithaca N. Y., and Washington State, agree with the description and with specimens from Europe in all particulars.

59a. Chironomus ferrugineovittatus Zetterstedt.

1850 Chironomus Zett. Dipt. Scand. 9:3492
1864 Chironomus Schiner. Fauna Austr. 2:602
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.251

Male and female. Head yellow, the antennae and palpi brown, antennal hairs of the male dusky yellow, antenna of the female yellow with a brown apical joint. Thorax pale yellow, with three broad ferruginous longitudinal stripes, pleura with ferruginous spots; pectus and metanotum gray; the flattened area in front of the scutellum with a whitish sheen. Scutellum as also the abdomen of the male for the most part yellowish, both with a suggestion of green; upon some of the abdominal segments a brown dorsal mark; the posterior segments with a whitish sheen;

the anal segment cordate, a third shorter than the one immediately preceding; forceps brownish yellow, slender and pointed; the hairs on the sides yellowish; abdomen of the female dark gray, with whitish incisures. Legs yellow with brownish articulations; the last two tarsal joints darkened; tarsal proportions as in plumosus; male fore tarsi hairy. Halteres yellow. Wings with a slightly yellow tinge, whitish in reflected light; the cross vein dark brown. Length 9 to 12 mm. Washington State.

60. Chironomus decorus n. sp.

(Pl.23, figs. 7 to 13; pl.29, fig.12)

Larva. The larvae were found everywhere in the ponds and ditches around Ithaca N. Y. They are blood red, and about 12 mm. long. The head is dark blackish brown; the antennae are short, normal. The dorsal sclerite is narrow ovate, posterior end pointed, truncate anteriorly, with three setae along each lateral margin, the first at the extreme anterior end, the last one half way between the anterior and the posterior end, the second midway between these. Articulated to the cephalic margin, and overhanging the mouth opening is the labrum. There are two pairs of prominent setae upon its dorsal surface; numerous papillae, two or which are quite prominent on the anterior margin and upon the anterior ventral surface. The arrangement of the setae and the armature of the epipharynx shown in fig.10. The epipharyngeal comb (c) has relatively long and uniform teeth; the lateral arms are dark brown in color. Each eye consists of two distinctly separated pigment spots. The mandibles (fig.7) are black-tipped, with a fringe of apical setae, a prominent lateral spine, and a group of mesad projecting branched setae; the hypopharynx has its usual papillae upon the fore margin; the maxillae are prominent, each with two lateral setae, the palpus is short and thick. The labium has a black margin with an outline as shown in fig.8. In many specimens the teeth appear to be slightly longer in proportion than shown in this figure. The anterior prolegs have very numerous curved setae. The body is nearly devoid of even minute setae. The anal prolegs are normal, claws dark, bilobed. Anal setae as usual. The eleventh body segment has four long white blood gills on the ventral surface, and caudad of the dorsal setae of the twelfth segment are four short ones.

The larva (1) mentioned by Garman (1888) is probably this species.

Pupa. Dusky greenish brown, the colors of the imago showing through the integument. Length 7 to 8 mm. Tracheal filaments prominent, white and much branched. Thorax with a few scat-

tered setae. Segments of the abdomen with a seta-pattern as shown in fig. 11 and 12; the pattern more indistinct on the last two segments. On each lateral margin of the fifth to the eighth segment there is a brown longitudinal dash, most conspicuous and half the length of the segment on the fifth. The black chitinized lateral spur of the eighth segment is prominent and without teeth (fig.12). The anal appendage has the usual fringe of matted hairs.

Imago, male. Length 6 to 7 mm. Head yellow, antennae and proboscis more or less brownish, large basal joint of the antennae and the palpi reddish brown, the latter sometimes fuscous. Thorax greenish yellow with a whitish sheen, the pleura and the scutellum the same color; the three thoracic stripes, some pleural spots, the metathorax and the pectus dull testaceous or reddish, sometimes even brownish; the middle dorsal line divided by a fine line. Abdomen hairy, pale yellow or greenish yellow, in life more distinctly green, infuscated toward the tip; each segment with a brownish transverse fascia slightly in front of the middle. These fasciae are widest on the dorsal line, and are obsolete on the last few segments. Genitalia brownish yellow, hairy, moderately elongated (pl.32, fig.13). Legs including the coxae pale greenish yellow, short haired; tarsi, particularly towards the tip, infuscated; tips of tibiae and of all tarsal joints fuscous, fifth joint wholly fuscous. Tarsal claws simple, pulvilli small, empodium stout, curved, blunt, and pectinate on the convex side. The fore metatarsus about 0.6 longer than its tibia. Wings hyaline, cross-vein conspicuously clouded with dark brown, anterior veins yellow, posterior ones hyaline, the two branches of the cubitus and the anal vein accompanied by a faint brown streak. Venation as shown on pl.29, fig.12.

Female. Differs from the male as follows: Slightly shorter, antennae yellow, last joint fuscous; thorax more greenish than yellow, abdomen greenish with dark bands as in the male, but the bands are always wider and usually cover the whole surface of the segment excepting the apical third or fourth. In other respects like the male. This species seems to be very common in many parts of the country. New York, Ohio, Illinois, Iowa, Kansas, Washington State, and Nebraska.

60a. Chironomus dorsalis Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:25, 10
1850 Chironomus Zett. Dipt. Scand. 9:3529
1864 Chironomus Schiner. Fauna Austr. 2:605
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.255
1830 Chironomus cingulatus Meig. Syst. Beschr. 6:245

1850 Chironomus Zett. Dipt. Scand. 9:3498
1834 Chironomus nigroviridis Macq. Suit. Buffon. 1:51
1850 Chironomus Zett. Dipt. Scand. 9:3529
1839 Chironomus venustus Staeger. Kröj. Nat. Tidsskr. 2:562
1850 Chironomus Zett. Dipt. Scand. 9:3496
1864 Chironomus Schiner. Fauna Austr. 2:603
1847 Chironomus waldheimii Gimmerth. Bul. Soc. Imp. Nat. Moscou. 20. 2:142, 69

Larva and pupa. Miall and Hammond (1900) state that the larva is blood red, and possesses both the ventral blood gills of the eleventh segment and the anal blood gills of the twelfth. The labium is as shown on pl.23, fig.1. The pupa is of the usual type, resembling the one shown on pl.16, fig.2. The abdominal markings and the spurs of the lateral fin of the eighth segment are not described.

Imago, male and female. Head yellowish; palpi and antennae dark brown, the last usually yellowish or reddish yellow at the base, the antennal hairs of the male pale brown with reddish yellow sheen; very dark varieties (var. nigroviridis) dark brown with pale brownish sheen. Thorax yellow, yellowish green, sometimes very pale green; the thoracic stripes, the pleura and the sternum chestnut, sometimes ferruginous, sometimes blackish; the metathorax always blackish brown; the middle thoracic stripe of the male divided by a fine depressed line, in the female more distinctly separated. Abdomen of the male a translucent green or yellowish green; the second and the following segments each with a large blackish brown dorsal mark which frequently is in the form of a cross band; the last segments are wholly blackish brown, with a whitish shimmer; abdomen of the female blackish brown with pale green pruinose margins to the segments. Legs pale green or yellowish; tips of the tibiae and of the tarsal joints brown; the fore metatarsus 1.5 times as long as the tibia, and nearly twice as long as the second joint; the following joints gradually diminishing in length; the fore tarsi bare. Halteres yellowish. Wings hyaline, the veins pale brown, the crossvein usually slightly clouded. Length 5.75 to 7.5 mm. Connecticut, Pennsylvania, South Dakota, Kansas.

61. Chironomus stigmaterus Say.

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:15, 6
1859 Chironomus Say. Compl. Wr. 2:42, 6
1828 Chironomus glaucurus Wied. Aussereurop. zweifl. 1:15, 3
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Tergum pale, toward the tip glaucous.

Male. Antennae pale yellowish brown; thorax pale cinereous, lines very pale testaceous, sometimes tinged with dusky; scutel

yellowish; metathorax reddish brown; wings white with a fuscous subcentral stigma; pectus testaceous; feet pale yellowish; tergum, basal segments pale reddish brown with whitish tips, terminal segments somewhat glaucous. Length 0.3 inch (=7.5 mm.). Habitat United States.

I have seen specimens, which I identify as this species and agreeing perfectly with the above description, from Kansas, Washington State, California, Wisconsin, Idaho, New Jersey and South Dakota. The male has hairy fore tarsi; the fore metatarsus in both sexes is about one-fifth longer than the tibia. The species resembles cristatus but differs in having paler thoracic stripes, in being generally paler, and in its metatarsal proportions. From festivus and tendens it differs in having a darkened crossvein.

62. Chironomus cristatus Fabr.

1805 Chironomus Fabr. Syst. Antl. 39, 4
1821 Chironomus Wied. Dipt. exot. 1:11, 1
1828 Chironomus Wied. Aussereurop. Zweifl. Ins. 1:14, 1
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

(Pl.29, fig.14)

Male. Dorsum of the thorax yellowish, with grayish-brown stripes; abdomen yellowish, brown banded. Length 8 mm.

Antennae brownish. The dorsum of the thorax with the usual three stripes, which, however, are not lead-colored, since they lack the metallic lustre, but are brown, and appear in different lights to be covered with a grayish bloom; the pleura have grayish spots, the sternum and the metathorax ash-gray. The brown cross band of each segment of the abdomen lies at the base of the segment; each band is somewhat wider at the middle, where it is somewhat prolonged into a fine line, sometimes reaching the posterior margin of the segment. Legs yellowish. North America. Wiedemann, loc. cit.

According to Fabricius (1805) the head is blackish and the legs pale with blackish articulations. Some male and female specimens from Chicago, Ill., and Ithaca, N. Y., agreeing with Wiedemann's description may be further characterized thus: Face and palpi brown; large basal joint of the antenna brown in the male; in the female the antenna is yellow except the apical joint; scutellum yellowish; the last two or three abdominal segments nearly wholly dark brown with cinereous bloom; male genitalia

dark brown. Legs yellow, knees of the fore legs and the fifth tarsal joint of all the legs pale brown; extreme tips of all the tibiae and of all the tarsal joints dusky; fore metatarsus about 1.5 times as long as its tibia; fore tarsi of male bare. Wings hyaline, veins yellow, the crossvein brown. Length 6.5 to 8 mm. New York, Illinois, Washington, Kansas, Idaho, South Dakota, New Jersey (Johnson).

62a. Chironomus tentans Fabricius

1805 Chironomus Fabr. Syst. Antl. p.38, 3
1818 Chironomus Meigen. Syst. Beschr. 1:24
1850 Chironomus Zett. Dipt. Scand. 9:3482
1864 Chironomus Schiner. Fauna Austr. 2:603
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.255
1818 Chironomus abdominalis Meig. Syst. Beschr. 1:32, 25
1804 Chironomus vernalis Meig. Klass. 1:13, 5

Larva. Concerning the larva Weyenbergh (1874) writes:

"The larvae were found among the rotting leaves in the water. They were full grown in March and the beginning of April; blood red in color, long and slender in form, and about 20 mm. in length. . . . The mandible is deep brown, chitinized and sharply toothed, particularly the vertex (pl.37, fig.28) is very sharp. The lower lip (labium) is also sharply toothed, the teeth symmetrically placed as shown on pl.37, fig.27. . . . The anal appendages are large. . . ."

Imago, male and female. Length 7.5 to 9.75 mm. Head grayish yellow; palpi dark brown; antennae of the male dark brown, the hairs paler brown, sometimes verging upon ferruginous; antennae of the female reddish yellow, darkened apically. Thorax pale yellow or light green; the moderately wide thoracic stripes, a line produced posteriorly from the median stripe to the scutellum, a part of the pleura and the metanotum, dark gray; the whole thorax especially when viewed from behind, with a whitish sheen. Abdomen dark gray, the segments with whitish or grayish posterior margins; the anal segment of the male short and broad, the claspers bent, *unusually stout*. Legs yellowish, the knees, the tips of the tibiae, and the whole of the tarsi, blackish; the fore metatarsus nearly one half longer than its tibia, the second tarsal joint about half as long as the first and but little longer than the third; the latter but little longer than the fourth; the fore tarsi not ciliate, even the hairs of the hind legs inconspicuous; these legs in both sexes robust. Halteres yellowish. Wings whitish; the anterior veins pale brown, crossvein slightly darker, the other

veins nearly colorless. The thoracic stripes of some specimens are ferruginous; the ground color of the entire insect in this case verges toward green; the antennal hairs of the male is then also mainly pale yellow. In this species the pale thorax contrasts strongly with the dusky abdomen. Translation; V. d. Wulp. loc. cit.

According to Zetterstedt (1850) the ratio of fore metatarsus to tibia is the same as in plumosus (i. e. one and one fourth to one). This is the case in specimens from Ithaca, N. Y., Idaho, South Dakota, Utah, Iowa.

63. Chironomus prasinus Meigen

1818 Chironomus Meig. Syst. Beschr. 1:22, 4
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.250, 2
1839 Chironomus intermedius Staeg. Kröjer: Naturh. Tids. 2:559, 3
1850 Chironomus Zett. Dipt. Scand. 9:3484, 3
1864 Chironomus Schiner. Fauna Austr. 2:601
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20
1818 Chironomus pilipes Meig. Syst. Beschr. 1:26, 13

Resembles plumosus but is smaller, the abdomen in living specimens is light green (which color in dried specimens becomes yellowish) with blackish dorsal spots which sometimes spread out in the form of a cross band, seldom wanting; posterior margins of the segments with a whitish sheen; abdomen of the female darker; with greenish white pollinose, posterior margins to the segments. The ratio of tibia to metatarsus, the hair of the legs, etc., like plumosus. Length 7.5 to 9 mm. Translation, V. d. Wulp, loc. cit. Northwest of North America. Osten-Sacken (1878). Idaho, Minnesota, New York.

According to Hammond (1885) the larva is blood red, and possesses both anal and ventral blood gills. Judging from a drawing given by him the labium of the larva appears to be like that figured on pl.37, fig.25.

64. Chironomus polaris Kirby.

1824 Chironomus Kirby. Suppl. App. Parry's 1st Voyage. CCXVIII
1831 Chironomus Curtis. Ross' Voyage. LXXVII
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21
1898 Chironomus Lundb. Vidensk. Meddel. p.288

Black, hairy, wings lacteous, iridescent, the costa fuscous with nervures darker, halteres dirty ochre. Length 7.5 mm. Breadth, 12 mm. Curtis, loc. cit.

Lundbeck (1898, 272) says in regard to this species and C. borealis Curtis, that they are probably identical with either C. hyperboreus or C. staegeri. He says further that C. polaris of Holmgren is not identical with either of the above-named species, he having seen the Holmgren specimens. In Holmgren's species the fore metatarsus is shorter than the tibia, while according to the figure given by Curtis in Ross' Voyage LXXVII, it appears that polaris Kirby is a true Chironomus (sens. str.). Arctic regions.

65. Chironomus attenuatus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:20
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Body dark gray, thinly clothed with yellow hairs; abdomen very long, fringed with hairs on each side; feelers brown; legs dull yellow, hairy, especially the four hinder thighs and shanks; fore feet very long, hairy at the base; wings slightly gray, with the usual dark spot on each, and having a fringe of very short hairs; veins brown; poisers dark gray. Length of the body 3 lines (=6 mm.); of the wings 5 lines (=10 mm.). St Martin's falls, Albany river, Hudson's bay.

According to the heading of the group to which this species belongs the author states that the wings are hairy. White mountains, New Hampshire (Slosson).

66. Chironomus crassicollis Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:18
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Body blackish brown, downy; chest thick; abdomen much narrower than the chest; feelers and legs brown; wings white, not hairy, very iridescent; veins pale yellow; poisers brown. Length of the body one line (=2 mm.); of the wings 1.5 line (=3 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

67. Chironomus fimbriatus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:20
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Body brown, hairy, abdomen fringed with hairs; feelers and legs pale brown, the latter hairy; wings colorless, hairy, fringed; poisers pale brown. Length of the body one half line (=1 mm.); of the wings one line (=2 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

68. Chironomus nigritibia Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:16
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Wings bare; chest black; abdomen yellow at the base; palpi brown; legs yellow; tips of thighs and of shanks, and of joints of the feet, black; wings colorless; a broad brown band across each wing, faint toward the hind border; veins brown; yellow towards the base; poisers lemon-color. Length of body 2.25 lines (=4.5 mm.); of wings 4.5 lines (=9 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

This species may be the same as C. brachialis Coq.

69. Chironomus borealis Curtis

1831 Chironomus Curtis. Ross' Voyage. LXXVII
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Black, thorax gray, abdomen with 7 whitish rings; costa fuscous; legs lurid. Length, 6 mm. Breadth, 12 mm.

Black, basal joint of the antennae ochreous; thorax hoary; abdomen clothed with long subdepressed yellowish hairs, the margins of the segments shining whitish or silvery; wings lacteous, opalescent, the costa fuscous, the nervures darker; halteres yellow; legs dull castaneous ochre, tips of the thighs and tarsi fuscous. Arctic regions. Curtis, loc. cit. Greenland.

According to Lundbeck (1898) this species may be the same as either C. hyperboreus, or C. staegeri, though Curtis' description is too brief to admit of a positive statement.

70. Chironomus albistria Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:17
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Body reddish brown; stripes on the chest red or flesh-color; side stripes passing into two broad white stripes; sides of chest hoary; scutcheon pale red; abdomen dark brown, hairy; sutures of the segments paler; feelers pale brown; legs pale tawny, hairy; tips of thighs, of shanks, of feet, darker; wings whitish, not hairy; veins pale yellow; poisers white. Length of the body 3 lines (=6 mm.); of the wings 4.5 lines (=9 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

71. Chironomus brunneus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:21
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Wings hairy. Head and chest brown, the latter with the usual three stripes of a pale gray color; abdomen of a yel-

lowish brown; feelers brown; legs yellowish brown; thighs yellow at the base; wings colorless; veins and poisers yellow. Length of the body 1.75 lines (3½ mm.); of the wings 3.5 lines (=7 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.; New Jersey (Johnson).

72. Chironomus lasiopus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:19
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Female. Wings hairy. Head and chest yellow; the usual three stripes on the latter brown, confluent, and occupying the whole of the back; feelers brown; scutcheon dingy yellow; hind chest black; abdomen brown, with a broad, dingy yellow band on the hind border of each segment; legs clothed with short yellow hairs; thighs yellow; shanks darker; feet brown; wings colorless, with the usual spot on the disk; veins brown, poisers pale yellow. Length of body, 2.5 lines (=5 mm.); of the wings, 4 lines (=8 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

73. Chironomus hilaris Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:17

Male. Wings bare. Body straw-color; head and chest tawny, the latter produced in front, and having its usual three stripes of a yellow color; feelers tawny; eyes black; legs brown; thighs white towards the base; middle shanks pale yellow, excepting the base and the tips; wings white, each having a broad, irregular, brown band across its disk; veins yellow; poisers pale yellow. Length of the body 1.5 lines (=3 mm.); of the wings 3 lines (=6 mm.). Habitat unknown. Walker, loc. cit.

74. Chironomus anticus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:21
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Wings hairy. Chest a little produced in front, silky white, with the usual three stripes of bright tawny color; abdomen pale yellow, hairy; last two segments dull tawny; legs pale yellow, hairy; a tawny band round each hind thigh; tips of the thighs, of the shanks, and of the joints of the feet, tawny; wings whitish from the base to the middle, pale tawny thence to the tips, slightly fringed; poisers pale yellow. Length of body 2.5 lines (=5 mm.); of wings 4 lines (=8 mm.). Georgia. Walker, loc. cit.

75. Chironomus bimacula Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:15
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Female. Wings bare; body citron color; chest produced in front, with the usual three stripes of orange color; a black dot

at the tip of each side stripe; feelers brown; legs dingy yellow; wings pale; veins and poisers pale yellow. Length of body 1.25 lines (=2.5 mm.); of wings 2.5 lines (=5 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

76. Chironomus confinis Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:15
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Pale yellowish green; chest with the usual three lines dull red; the middle stripe divided; hind chest brown; abdomen green, yellowish towards the base, darker at the tip; the sides hairy; feelers brown; legs dull yellow, hairy; wings colorless, hairy; veins pale brown; poisers white.

Female. Chest yellow; middle stripe not divided; abdomen dingy yellow. Length of the body one line (=2 mm.); of the wings two lines (=4 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit. In the heading of the group Walker says that the wings are bare.

77. Chironomus pellucidus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:21
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Male. Body pale yellowish green; feelers pale brown; abdomen and legs very hairy; wings colorless, hairy, deeply fringed; veins dull yellow; poisers pale yellow. Length of the body ¾ line (=1.5 mm.); of the wings 1.5 line (=3 mm.). St Martin's falls Albany river, Hudson's bay. Walker, loc cit.

78. Chironomus trichomerus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:21
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Male. Wings hairy. Pale greenish yellow; sides of abdomen fringed with hairs; eyes black; feelers and legs yellow, the latter thickly clothed with short hairs; wings whitish, deeply fringed; poisers pale yellow. Length of the body one line (=2 mm.); of the wings two lines (=4 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

79. Chironomus sp.

(Pl.23, fig.13)

In the figure mentioned above is shown the labium of a blood worm found in Fall creek, Ithaca N. Y., in the quiet water. This labium resembles that of Chironomus decorus, but the teeth are considerably longer.

80. Chironomus sp.

1896 Chironomus Osborn. Bul. Iowa Exp. Station. p.405

The larvae were found in the city water at Boone, Iowa. The larva is figured and briefly described by Osborn, loc. cit. It is blood red, possesses the four ventral blood gills of the eleventh segment as well as the anal gills. The figure shows the labium with the middle tooth shorter than the first laterals; the last laterals longer than those immediately preceding (pl.37, fig.26, after Osborn).

81. Chironomus sp?

(Pl. 22, fig.7)

Yellow larvae 6 or 7 mm. long from Saranac Inn N. Y. Head pale yellow, tip of mandible and labium black. The labrum, antennae and epipharynx resemble that of Orthocladius shown on pl.25, fig.3. The lateral surface of the mandible is not wrinkled; the maxillae and the labium are as shown in pl.22, fig.7. The setae of the anterior prolegs are delicate, curved and apparently not pectinate. The posterior appendages resemble those shown on pl.25, fig.6.

82. Chironomus sp.

(Pl.22, fig.22)

Larvae from Saranac Inn and from Ithaca N. Y. Blood red; length 8 to 10 mm.; resembling the larvae of C. flavicingula. Differ in having the middle pair of teeth of the labium paler than the laterals.

83. Chironomus sp.

A blood worm from Beebe lake, Ithaca N. Y.; resembles the larva of C. flavicingula in form, size, color, shape of prolegs, and appendages, etc. but differs in the form of its labium, there being an even number of teeth arranged as shown on pl.23, fig.6.

84. Chironomus sp.

The larvae (collected at Saranac Inn N. Y.) construct loose, black, cylindrical cases composed of sand, decaying leaves, etc. These cases are about four times as long as wide. The length of the larva is about 10 mm.; the maxillae resembles that shown on pl.22, fig.7. The margin of the labium is as shown on pl.22, fig.21. The eyes are each composed of two distinctly separated spots.

85. Chironomus sp.

1900 Chironomus Pettit. Mich. Acad. Sc.

The larvae are pale green in color, and very small and slender. They were found to mine in the water-lily leaves. The insect works by tunneling or plowing a furrow which extends from the

top of the leaf to the lower epidermis. This tunnel is often several inches in length and winds about in all directions in a serpentine manner. . . . From the front end of this tube the insect extends its head and feeds. . . . The pupae are apple-green in color, as are also the adults. Michigan.

Five species of larvae of Chironomus have been described by Garman (1888). Of these No. 1 is probably identical with C. decorus; No. 4 with plumosus; the others are described below.

86. Chironomus sp. Garman

1888 Garman. Illinois State Lab. Nat. Hist. Bul. 3:160

Larva No. 2. Length about 10 mm. Head pale brown, under side black. Two eye specks. Labium with four teeth on each side; median tooth shorter than the two next it. Hairs of anterior pediform appendage rusty. A pair of small club-shaped (respiratory ?) appendages at posterior edge of the penultimate segment. Anal papillae conspicuously enlarged distally. Illinois.

87. Chironomus sp. Garman

1888 Garman. Illinois State Lab. Nat. Hist. Bul. 3:160

Larva No. 3. Length about six mm. A single eye speck. Posterior segments without fleshy respiratory appendages. Anal papillae apparently jointed. Illinois.

88. Chironomus sp. Garman

1888 Garman. Illinois State Lab. Nat. Hist. Bul. 3:160

Larva No. 5. A very small pupa (3 mm.) taken in August still retained its larval skin, the labium of which differs from that of the preceding larvae in lacking the median tooth. Its condition would not permit of more extended comparison with the others, and it may prove the same as (3).

Genus 39. Cricotopus V. d. Wulp

Tijdschr. v. Entom. XVI (LXX) and XVII. 132-

Larva. Small, yellowish or green in color, the anterior abdominal segments stouter than the posterior ones. Eleventh segment without ventral blood gills. Antennae, labium, epipharynx and labium essentially like those of Chironomus. Maxilla with a number of mesad and cephalad projecting blades (pl.24, fig.1 *mx*). Mandible frequently transversely corrugated on its convex surface (pl.24, figs. 4 and 6). The anterior feet frequently with coarse pectinate setae.

Pupa. The thoracic respiratory organs are simple, tube-like, sometimes with enlarged extremities. Abdominal segments with minute and short setae. The anal segment with 6 terminal setae, three on each side.

The larvae and pupae of Orthocladius do not seem to differ from Cricotopus.

Imago. This genus resembles Chironomus, from which it is distinguishable in having the fore metatarsus a half or a third shorter than the tibia. The last abdominal segment of the male is much shorter than the preceding and is broader than long; the claspers are short and broad, and usually white in color (pl.33, fig.2). The legs are white and black annulate, the fore tarsi are bare or covered with very short and inconspicuous hair (in an exceptional case the male has bearded tarsi); the hind tarsi are also usually bare. The halteres are always white or pale yellow. Wings bare, the anal angle, particularly in the male, is prominent; R_{4+5} is straight or slightly bent at its extremity, the crossvein is a little beyond the middle of the wing; the cubitus is forked, the base of the fork a little distad of the crossvein; the lower branch is straight or gently arched toward the hind margin; the humeral crossvein is wanting or rudimentary.

The species of this genus are all small (2 to 4 mm.) and with black and yellow coloring, the dorsum of the thorax has 3 shining black stripes, which sometimes are so wide as to entirely obliterate the yellow dividing lines, so that only the humeri remain yellow.

KEY TO SPECIES OF CRICOTOPUS

Larvae

a Sides of each abdominal segment with pencil of long hairs, pl.24, fig.9 ..... 3. trifasciatus

aa Abdomen without such pencils

b Middle tooth of the labium longer than the first laterals, pl.24, figs. 1, 2, 4 ..... 4. exilis n. sp.

bb Middle tooth about as long as the first laterals, pl.25, fig.22 ..... 6. varipes

Pupae

a Pattern upon each abdominal segment in two wide transverse bands, resembling that shown on pl.25, fig.7 ..... 4. exilis n. sp.

aa Not marked in this manner

b Markings as shown on pl.24, fig.7; thoracic respiratory organs as shown on fig.8 ..... 3. trifasciata

bb Dorsum uniformly covered with minute spines ..... 6. varipes

Imagines

a At least the apical half of the middle and hind femora black
b Abdominal segments with narrow white posterior margins; fore metatarsus about one fourth or one third shorter than its tibia
1. tremulus
bb Abdomen with wide white or yellow fasciae
c Abdomen with the first, most of the third, half of the fifth, and posterior margins of the second and the fourth, yellow
2. geminatus
cc Abdomen not marked in this manner
d With the fore metatarsus about one half as long as the tibia
e With yellow bands on the first, fourth and seventh segments
3. trifasciatus (var. tricinctus)
ee With yellow bands on the first, fourth and fifth segments
4. exilis n. sp.
dd With the fore metatarsus about two thirds as long as its tibia
e With yellow bands on the first and fourth segments
5. bicinctus
ee With the first and second wholly, and a part of the third and fourth segments yellow.....6. varipes
aa Middle and hind femora for the most part yellow or white
b With first, fourth and seventh abdominal segments yellow
3. trifasciatus
bb Abdomen not marked in this manner
c Metatarsus of the fore legs about one half as long as the tibia; abdominal segments with yellow margins.....7. sylvestris
cc Fore metatarsus about two thirds as long as the tibia; abdominal segments with brown posterior bands.....8. debilis

NOTE.—Consult also the auxiliary key containing Walker's species, p.198.

In occasional specimens of some members of this genus the part which is usually yellow is found to be black. In this case, however, the black is shining, and easily contrasts with the velvet black of the other parts.

1. Cricotopus tremulus Linne

1758 Tipula Linn. Syst. Nat. ed. X. p.587, 23
1767 Tipula Linn. Syst. Nat. ed. XII. p.975, 31
1804 Chironomus Meigen. Klass. 1:15, 11
1818 Chironomus Meigen. Syst. Beschr. 1:45, 56
1850 Chironomus Zett. Dipt. Scand. 9:3562, 88
1864 Chironomus Schiner. Fauna Austr. 2:611, 72
1884 Cricotopus Mik. Wien. Ent. Zeitg. 3:202
1899 Cricotopus Johnson, in Smith's Cat'l. Ins. N. J. p.627

Male. Dorsum of the thorax yellow, with wide, posteriorly confluent longitudinal shining black stripes; the pleura sometimes paler with black spot at the base of the wing; the scutel-

lum and the metanotum shining black. The abdomen dull black, basally and at the incisures whitish; anal segment thicker than the preceding one; the forceps white. Head black, the antennae brown, its hairs lighter at the tip. Legs black or brown, anterior coxae, with all the femora at their bases and wide bands on the middle of all the tibiae white; the second and third joints of all the tarsi also white; the fore metatarsus markedly shorter than the tibia. Wings grayish, in certain lights whitish. Halteres white.

Female. Differs from the male in having darker veins in the wings. Length 2 to 3 mm. New Jersey (Johnson).

Translation from Schiner, loc. cit.

2. Cricotopus geminatus Say.

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:14, 4
1859 Chironomus Say. Compl. Wr. 2:42, 4
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20
1899 Cricotopus Johnson, in Smith's Cat'l. Ins. N. J. p.627

Thorax fuscous; pleura gray; abdomen white, annulate with black. Humerus gray, the color being a continuation of that of the pleura; pectus livid; feet white; thighs blackish, pale at the base; tibia at base and tip, and tarsi at tip fuscous; abdomen with three broad double bands, formed thus: second segment fuscous with the exception of the posterior margin, third segment fuscous on the basal margin, fourth segment fuscous excepting the posterior edge, fifth segment fuscous on the basal half, sixth and seventh segments entirely fuscous. Length 3-20 of an inch (3.75 mm.). Pennsylvania. Say, loc. cit. New Jersey (Johnson).

3. Cricotopus trifasciatus Panzer

1813 Chironomus Panz. Faun. Germ. p.109, 18
1818 Chironomus Meigen. Syst. Beschr. 1:42, 50
1850 Chironomus Zett. Dipt. Scand. 9:3556, 83
1864 Chironomus Schiner. Fauna Austr. 2:610
1818 Chironomus tricinctus Meigen. Syst. Beschr. 1:41, 49
1850 Chironomus Zett. Dipt. Scand. 9:3555, 82
1864 Chironomus Schiner. Fauna Austr. 2:610
1874 Cricotopus V. d. Wulp. Tijds. v. Ent. 17:132
1877 Cricotopus V. d. Wulp. Dipt. Neerl. p.272, 3
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

(Pl.24, figs. 5 to 10; pl.29, fig.15)

Larva. The larva is yellowish with a brownish or reddish tinge. Some are wholly yellow. Length 4 to 5 mm. This larva differs from all others thus far examined in having a bunch of long, fine, pale yellow hairs (pl.24, fig.9) near each lateral margin

of each of the abdominal segments. The hair tufts are about as long as a single body segment, excepting on segments one and two, where they are shorter or entirely wanting. The head is brown, about 1.5 times as long as wide; antennae, labrum, and epipharynx resembling those shown on pl.25, fig.3; the setae at the apex of the labrum longer than shown here. Mandibles (pl.24, fig.6) with a branched basal and two simple dorsal setae; convex side wrinkled. Maxillae (fig.5) with short palpus, a few papillae and a tuft of mesad projecting setae. The labium (fig.5) somewhat triangular, having a toothed outline as shown in the figure. Prothoracic feet with numerous curved yellowish brown setae. Abdominal setae as described above. The anal prolegs and appendages were destroyed in the few specimens which I have.

Pupa. Length 3 to 4 mm. with black and yellow markings of the adult showing through the integument. Each prothoracic respiratory organ is slender, nearly cylindrical, with smooth surface and rounded ends, its length about 0.25 mm. (fig.8.). The markings of the second, third and fourth abdominal segments as shown in fig.7. The fifth, sixth and seventh are similarly though much less plainly marked. The markings on each segment consist of a large area of very minute caudad projecting setae with a few scattered bare patches, a transverse band of stouter caudad projecting setae near the posterior margin and a band of cephalad projecting setae upon the margin. The latter band is particularly conspicuous on the second segment. The caudal appendage is quite small, and is provided with three pale setae on each posterior angle (fig.10, which also shows the male genitalia of the enclosed imago).

Imago, male. Dorsum of the thorax yellow, with three wide nearly confluent shining black stripes; a spot on each pleuron, the scutellum, sternum and the metathorax also black. The abdomen dull black, the first, fourth and seventh segment with pale yellow cross bands; besides this the posterior margins of the other segments narrowly white; anal segment thicker than the others; forceps white. Head yellow; the palpi black; the antennae brown, its hairs white at the tip. Legs black, the fore coxae, the bases of all the femora, a broad band on each tibia whitish; the fore tarsi black or brown, each middle tarsus with its two basal joints, and each hind tarsus with three basal joints white. Metatarsi of the fore legs of the male only one half as long as the tibiae. Wings whitish.

Female. Abdomen more yellowish; one may say, abdomen yellow with three black fasciae, the two anterior ones each divided by the light colored incisures; the legs also with more yellow.

Length 3 to 4 mm. Schiner, loc. cit. (tricinctus). North America (O. S.); Ithaca N. Y.; Chicago Ill.

"The variety with less black, the thoracic stripes narrower, and the femora only black at the tip, is known as var. trifasciatus". V. d. Wulp (1877).

4. Cricotopus exilis n. sp.

(Pl.24, figs. 1–4; pl.29, fig.16; pl.33, fig.2)

Larva. The yellowish green larvae were taken from the rocky bottom of the shallow but swift, Fall creek water at Ithaca N. Y. Length, 4 to 5 mm. In most of its details the larva is like that shown on pl.25, figs. 12 to 15; but I fail to find a seta on each side at the base of the labium. The lateral surface of the mandible is wrinkled (fig.4), and the curved setae of the epipharynx are more prominent (fig.2); neither are the oblique wrinkles below the teeth of the labium present. Claws of anterior prolegs are coarse and pectinate.

Pupa. The pupa is yellowish with black; the colors of the adult showing through the integument. Length about 2 mm. The markings of the abdominal segments resemble those shown on pl.25, fig.7. The caudal appendages consist of the genital sacks and the three setae at the end of each lateral process of the anal segment.

Imago, female. Head, occiput and upper half of front blackish, the narrow horizontal space above the antennae and face bright yellow; palpi brownish; probocis yellow; antennae brown, the two basal joints yellowish, antennal hairs whitish with an occasional black one. Thorax dusky yellow with three wide shining black stripes, the median one much abbreviated behind, and very narrowly divided posteriorly by a yellow stripe, lateral stripes much abbreviated in front. Pleura yellow with 4 brownish spots or bars at base of wings; pectus yellowish brown; scutellum and metanotum black, the latter with a very narrow yellow median line. Abdomen black and yellow, its dorsum with yellow markings as follows: First segment, narrow basal margin of second, very narrow apical margin of third, all of the fourth and fifth except brownish clouds among the marginal setae, sixth, seventh and eighth faintly at base and apex, and all of anal segment; thus leaving most of the second, third, sixth, seventh and eighth blackish. Genitalia white. Sides of abdomen and venter sordidly yellow, darkened apically. Near the posterior margin of each segment there is a row of black setae, excepting on the first segment, where they are paler colored. Coxae yellowish. The basal one fourth of the fore and basal one half of middle and hind

femora, yellow; the remainder of the femora black, but the line of division not sharply marked. Fore tibiae white with black bases and tips; middle and hind tibiae yellow with black tips, and sometimes bases also. Fore tarsi dark brown; middle and hind ones yellowish brown, each joint darkened apically; fore metatarsus about one half as long as its tibia. Wings bare and spotless, veins yellow. Venation as figured. Halteres yellow.

Male. Like the female but with less yellow; antennae brown with yellow basal joints, hairs pale brownish; genitalia white, length 1.5 to 2 mm. Ithaca, N. Y.

5. Cricotopus bicinctus Meigen.

1818 Chironomus Meig. Syst. Beschr. 1:41, 48
1850 Chironomus Zett. Dipt. Scand. 9:3553, 81
1864 Chironomus Schiner. Fauna Austr. 2:610
1874 Cricotopus V. d. Wulp. Tijds. v. Ent. 17:132
1877 Cricotopus V. d. Wulp. Dipt. Neerl. p.271, 2
1830 Chironomus dizonias Meig. Syst. Beschr. 6:252, 101

Head with the antennae and mouth parts black, the antennal hairs of the male whitish at the tip. Thorax shining black with yellow humeral spots (male) or yellow with wide sometimes confluent longitudinal lines (female); scutellum, metanotum, sternum black. Abdomen black, the first and the fourth segments and in the female the venter also, yellow; the claspers of male snow white. Legs black, fore coxae and the bases of the femora pale yellow; each tibia on its middle section, together with the hind tarsi, except the tips of the joints, white; fore metatarsus one third shorter than its tibiae. Wings whitish, the anterior wing veins and the crossveins pale brown (pl.29, fig.17). Length 2¼ to 3 mm. V. d. Wulp, loc. cit.

Several specimens from Ithaca, N. Y., agree perfectly with this description. In one or two specimens of the male, the yellow humeral spot is indistinct, and in another it is wanting. In some specimens also the hind legs are pale brown, so that the white tibial ring is conspicuous only on the fore legs. In some female specimens the thoracic stripes are brownish.

6. Cricotopus varipes Coquillett

1902 Cricotopus Coq. Proc. U. S. Nat. Mus. 25:93

Larva. Yellowish, or with a greenish tinge. The body tapers both toward the head and caudal end; hence the middle body segments are of greater diameter. Length 6 to 7 mm. Head dark brown, labrum, and epipharynx resembling C. exilis, the

epipharynx with several pairs of rather stout curved spines, besides several small setae; the lateral arms stout, with black apices. The mandibles wholly black, with the lateral surface faintly wrinkled, apical tooth long and slender. Antennae and labrum as with C. exilis and Orthocladius fugax (see pl.25, fig.3). The labium and maxillae as shown on pl.25, fig.22. Each eye consists of two spots nearly in contact, the anterior spot much smaller than the posterior. Setae of the anterior prolegs are coarse, curved, but apparently not pectinate. Posterior appendages resembling those shown on pl.25, fig.6.

Pupa. Colors yellow and black. Length about 5 mm. Respiratory organ not discovered in the single specimen in my possession. Dorsum of abdominal segments uniformly covered with minute spines. Anal appendage like that of C. exilis.

Imago, male. (Pl.29, fig.18.) Head and its members black, hairs of antennae gray; thorax black, mesonotum highly polished; metanotum and scutellum opaque, velvet black; abdomen velvet black, the first two segments and the hind margins of the following two polished yellow; genitalia yellow; femora black, the extreme bases and trochanters yellow, front tibiae and tarsi brown, the former with a broad median white band, other tibiae and tarsi yellow, their apices brownish, legs only pubescent, first joint of front tarsi two thirds as long as the tibiae; wings whitish hyaline; small crossvein slightly darker than the adjacent veins, R_{4+5} almost straight; halteres yellow; length 2.5 mm. Great Falls, Md. Coquillet, loc. cit.

Female. Like the male excepting for sexual characters. The white band on the fore tibiae is nearer the base than the tip, so that the black at the basal articulation is much less than at the apical end. The yellow margins of the third and fourth abdominal segments are quite narrow, and nearly wanting in some specimens. The thorax of the female is more brownish, polished, with pleura and humeri paler, sometimes yellowish. Male and female from Saranac Inn, N. Y., Ithaca, N. Y., Washington State.

7. Cricotopus sylvestris Fabricius

1794 Tipula Fabr. Ent. Syst. p.252, 89
1805 Chironomus Fabr. Syst. Antl. p.47, 46
1818 Chironomus Meigen. Syst. Beschr. 1:43, 53
1850 Chironomus Zett. Dipt. Scand. 9:3558, 85
1864 Chironomus Schiner. Fauna Austr. 2:611
1874 Cricotopus V. d. Wulp. Tijds. v. Ent. 17:132
1877 Cricotopus V. d. Wulp. Dipt. Neerl. p.274, 8
1899 Cricotopus Johnson, in Smith's Cat'l. Ins. N. J. p.627

1826 Chironomus triannulatus Macq. Recueil Soc. Sc. Agri. Lille. p.202, 30
1838 Chironomus Meigen. Syst. Beschr. 7:9, 139
1804 Chironomus vibratorius Meigen. Klass. 1:16, 13

Male. Dorsum of the thorax yellow, with three black stripes, often confluent posteriorly, a spot on each pleuron, the scutellum, sternum and the metanotum shining black. The abdomen black, the base and the incisures yellowish or whitish, the incisures of the fourth and fifth segments usually wider, fascia-like; in fact the markings of the abdomen somewhat variable; the anal segment wide; the forceps white. Head brownish yellow; the palpi darker; antennae brown, its hairs lighter at the tips. Legs black, the fore coxae and femora narrowly white at the bases, each tibia with a wide white or yellow band at the middle, middle femora with the bases widely yellowish, hind femora whitish to the tip; fore tarsi all black or brown; middle tarsi to the third, the hind tarsi to the fourth joint whitish; metatarsus of the fore leg about one half as long as its tibia. Wings whitish; venation as figured (pl.29, fig.19).

Female. The female has the base of the abdomen and the venter yellow, the incisures being whitish. Length 2 to 3 mm. Schiner, loc. cit. New Jersey (Johnson). Some specimens from Chicago, Ill., agree perfectly with the above descriptions.

8. Cricotopus debilis Williston

1896 Orthocladius Will. Trans. Ent. Soc. London. p.275
(Pl.29, fig.20)

Male. Red or reddish yellow. Plumosity of the antennae brownish-black. Mesonotum with three shining brown spots or stripes, narrowly separated. Abdomen slender; each segment with brown posterior band. Legs yellow; front femora brown on distal end; front tibiae light yellow on the proximal half or two fifths, dark brown on the distal portion, about one third longer than the corresponding metatarsi; front tarsi infuscated; the four posterior femora somewhat infuscated distally. Wings hyaline. Length 2.5 to 3 mm. Williston, loc. cit. St Vincent Island.

I have examined a cotype specimen of this species now in the Cornell university collection, and find that it should be included with Cricotopus, instead of with Orthocladius as Professor Williston has it; unless, as the Abbe Kieffer has already pointed out, Cricotopus should be considered as a synonym of Orthocladius.

Genus 40. Camptocladius V. d. Wulp

Tijdschr. v. Entomol. XVI (LXX); XVII, 133

Resembles in most respects Cricotopus; the fore metatarsus is shorter than its tibia; the anal segment of the male is short and broad, the claspers white with white hairs. Legs unicolored, at least not white and black annulate. The halteres of most of the known species are dark. Wings bare, R_{4+5} is bent upwards, sometimes short and ending noticeably before the end of the costa, or running close to it for a distance, the cell R_{4+5} therefore quite broad; the crossvein usually on or proximad of the mid length of the wing; the cubitus forked, the base of the fork usually noticeably distad of the crossvein; the lower branch sinuous (pl.30, figs. 1 to 4). Usually small black species from 1.5 to 3 mm. in length. In other respects like Chironomus.

The larvae of some species have been found in dung. According to Arribalzaga the palpus in Camptocladius has but one joint; in all the species that I have seen there are four joints as in Chironomus.

KEY TO SPECIES OF CAMPTOCLADIUS

Imagines

a Thorax with more or less yellow

b Abdomen and thorax yellow, the latter with three wide blackish lines; wings slightly hairy (Greenl.) ..... 1. graminicola

bb Abdomen pale fuscous, or fuscous

c Anterior crossvein is about one third the wing length from the base; thorax yellow, black-striped; abdomen pale fuscous, more yellowish anteriorly; legs yellow; length 1.5 mm.; female ..... 2. Camptocladius sp.

cc Anterior crossvein is two fifths wing length from the base; abdomen fuscous; length 2 mm. ..... 3. fumosus n. sp.

aa Thorax wholly black

b The crossvein is noticeably proximad of the fork of the cubitus

c Fore metatarsus about one third shorter than its tibia

d R_{4+5} not parallel to the costa, the cell above it quite distinct; wings hyaline, whitish; length 2 mm. ..... 4. aterrimus

dd R_{4+5} long, and curves so as to be nearly parallel to the costa, nearly obliterating the cell above it, especially toward the apex; wing often with a slightly smoky tint; body subshining; no black dash at the base of the wing; length 1.5 mm. ..... 7. minimus

cc Fore metatarsus about one half as long as its tibia

d Fore legs pubescent, middle and hind ones sparsely short pilose; palpi black, thorax black, lightly cinereous, with two rows of yellowish hairs; wings white; length 1.75 to 2.25 mm. (Greenland) ..... 5. pumilio

dd Not as described above

e The posterior branch of the radius ends far before the tip of the wing; wing milk white with a short black bar at its base; antennae of the male with pale hairs; length 1.5 to 2 mm. .....6. b y s i n n u s

ee R_{4+5} moderately long; peduncle of the halteres pale; wing milky white; antennae and palpi black (Greenland)...8. p a r v u s

bb Crossvein but little if any proximad of the fork of the cubitus. Greenland species

c Middle legs very pilose.....9. v e l u t i n u s

cc Middle tibiae and tarsi nearly bare.....10. e x t r e m u s

NOTE—Compare also the auxiliary key containing Walker's species on p.198

1. Camptocladius graminicola Lundbeck

1898 C h i r o n o m u s Lundbeck. Vidensk. Meddel. p.278, 59
1902 C a m p t o c l a d i u s Kertesz. Cat'l. Dipt. 1:214

Male. Thorax yellow, subshining, with three blackish brown stripes, the middle one posteriorly, the lateral ones anteriorly abbreviated; the pleura yellow, the pectus blackish brown, scutellum yellow, metathorax brown. The abdomen yellow, with yellow hairs, toward the tip sometimes a little darkened. The antennae yellow or pale brown, the palpi yellow. The legs also yellow or pale brown. The halteres yellow; the wings white, the anal lobe moderately produced, obtuse-angled, the veins pale, toward the costal border a little darker. The vein R_{4+5} is straight, the costa is produced a little beyond the tip of the wing, M is almost straight, and runs into the tip of the wing, the cubitus forks under the crossvein, its upper branch enters the wing margin under the tip of R_{4+5}; its lower branch is suddenly deflected. The middle and hind legs are yellow pilose, the fore pair pubescent, the anterior metatarsus a little shorter than the tibia.

Female. Similar to the male, but shorter, and also paler in color; the antennae shorter than the thorax, the abdomen pale yellow, the posterior margins of the segments darker, the wings wider, and finally, the tip of the wing very thinly haired. Greenland. Lundbeck, loc. cit.

The male has a few very indistinct hairs upon its wing near the apex; the hairs upon the wing of the female are rather more conspicuous. Lundbeck, loc. cit.

From this statement it appears that this species might with propriety have been classed with M e t r i o c n e m u s.

2. Camptocladius sp.

(Pl.30, fig.1)

Female. A single specimen from Lake Forest Ill. resembles the next species, C. f u m o s u s, but differs in being paler or more yellowish, and in having the small crossvein at about one third the wing length from the base. Length 1.5 mm.

3. Camptocladius fumosus n. sp.

(Pl.30, fig.2)

Male. Fuscous. Head and palpi dusky yellowish, occiput grayish; antennae wholly fuscous, the hairs brown. Dorsum of thorax with three wide subshining black or dark brown stripes, the anterior margin, the humeri, the narrow lines separating the dorsal stripes, and the pleura yellow, the scutellum brownish yellow; sternum and metanotum subshining brown or blackish. Abdomen and genitalia uniformly fuscous, with pale hairs. Legs pale fuscous, the bases of the femora yellow. Hairs pale. Front metatarsus about one half as long as its tibia. Wings hyaline with a yellowish tinge; the fork of the cubitus is beyond the crossvein; tip of R_{4+5} is rather close to the tip of the wing and distad of the extremity of Cu_1. Halteres yellow. Length 2 mm. Ithaca N. Y.

4. Camptocladius aterrimus Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:47, 59
1839 Chironomus Staeger. Kröj. Tidsskr. 2:578, 61
1850 Chironomus Zett. Dipt. Scand. 9:3573, 99
1864 Chironomus Schiner. Fauna Austr. 2:612
1874 Camptocladius V. d. Wulp. Tijd. v. Ent. 17:133
1877 Camptocladius V. d. Wulp. Dipt. Neerl. p.276

Velvet black. Antennae, legs and halteres black, plume of the antennae of the male blackish, with a whitish shimmer near the tip. Fore metatarsus about one third shorter than its tibia. Wings whitish, the anterior veins pale brown, the others uncolored, without a short black longitudinal dash at the root of the wing, R_{4+5} gradually bent toward the costa and joining it not far from the end; the posterior branch of the cubitus somewhat less bent than in C. byssinus; length 2.25 mm. Fork of the cubitus noticeably distad of the crossvein. V. d. Wulp, loc. cit. Greenland: Staeger, loc. cit.; Michigan; New Jersey.

5. Camptocladius pumilio Holmgren

1869 Chironomus Holmg., K. Svensk. Vet. Akad. Handl. 8:5, 41
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21
1898 Chironomus Lundb. Vidensk. Meddel. p.276, 57
1902 Camptocladius Kertesz. Cat'l. Dipt. p.1:215

Male. Thorax black, lightly cinereous, subshining, posteriorly with two cinereous, strongly approximated stripes, with yellow pile arranged in two rows. Abdomen black or fuscous black, the base sometimes paler, shining, and with yellow pile. The antennae a little longer than the thorax (not shorter as Holmgren has it). The palpi are black; the legs are more or less brown. The halteres are fuscous black, with the peduncle sometimes sordidly white. The wings are whitish hyaline, the anal

lobes moderately produced, rounded, obtuse angled; the veins toward the costal border are brown, the others thin and pale, both branches of the radius curved; the costa does not extend beyond the tip of the vein R_{4+5}, the media runs into the margin of the wing a little beyond the tip, cubitus forks far distad of the crossvein, its anterior branch ends in the posterior margin of the wing a little proximad of the end of R_{4+5}, the posterior branch is suddenly deflected. The middle and hind legs are sparsely pilose, the fore pair is pubescent; the metatarsus of the fore legs is but little more than one half as long as its tibia.

Female. The antennae shorter than the thorax, the wings shorter and wider, the veins a little more distinct, the media more curved, and the abdomen more robust; everything else as with the male. Length, male and female, 1.75 to 2.25 mm. Greenland. Lundbeck, loc. cit.

6. Camptocladius byssinus Schrank

1803 Tipula Schrank. Fauna Boica. 3:76, 2330
1818 Chironomus Meigen. Syst. Beschr. 1:46, 58
1845 Chironomus Staeger. Kröjer. Naturh. Tids. n. s. 1:352, 7
1850 Chironomus Zett. Dipt. Scand. 9:3572, 98
1864 Chironomus Schiner. Fauna Austr. 2:612
1874 Camptocladius V. d. Wulp. Tijdschr. v. Ent. 17:133
1877 Camptocladius V. d. Wulp. Dipt. Neerl. p.276
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20.
1898 Chironomus Lundb. Vidensk. Meddel. p.273, 53

Velvet black; antennae brownish, plume of the male antenna whitish. Legs blackish brown or pitchy, the hind legs hairy, the fore metatarsus about one half as long as its tibia, the remaining joints in decreasing lengths. Halteres black. Wings milk white, with almost colorless veins excepting at the root of the wing, where there is a short black dash (the basal portion of R); R_{4+5} short, bent toward the costa, which it enters far from its extremity (pl.30, fig.3); the cell R_{2+3} hence quite wide even near its apical end; posterior branch of the cubitus sinuous; fork of the cubitus noticeably distad of the crossvein. Length 1.75 to 2.25 mm. V. d. Wulp, loc. cit. New Jersey. (Johnson, 1899); Greenland (Staeger and Lundbeck); Ithaca N. Y., Michigan, Washington State, Alaska.

7. Camptocladius minimus Meigen

1818 Chironomus Meig. Syst. Beschr. 1:47, 61
1850 Chironomus Zett. Dipt. Scand. 9:3573, 100
1864 Chironomus Schiner. Fauna Austr. 2:612
1874 Camptocladius V. d. Wulp. Tijd. v. Ent. 17:133
1877 Camptocladius V. d. Wulp. Dipt. Neerl. p.277

Black, slightly shining. Antennae black, the plumes of the male dark brown. Legs blackish or pitchy or even yellowish brown; the fore metatarsus one third shorter than its tibia. Halteres black. Wings with a grayish tint; the anterior veins pale brown, the others uncolored; no black dash at root of wing; R_{4+5} bent upwards toward the costa and for a short distance appears to coalesce so that at a casual glance it appears thickened at the end; posterior branch of cubitus not so strongly bent as in byssinus; fork of the cubitus noticeably distad of the crossvein, pl.30, fig.4. Length 1.25 to 1.75 mm. Ithaca N. Y.; Idaho. Larva found in dung (Howard, 1901).

8. Camptocladius parvus Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.275, 55
1902 Camptocladius Kertesz. Cat'l. Dipt. 1:215

Female. Thorax black, somewhat shining, with two sometimes indistinct cinereous stripes, or with three black stripes, the middle one posteriorly, the lateral ones anteriorly, abbreviated. The scutellum is brown, the abdomen is black or fuscous, slightly yellow pilose. The antennae and palpi are dark. The legs are brown, more or less pale. The halteres are dark, the peduncle and the base of the knob sordidly white. The wings are hyaline, in certain lights clear white, pruinose or milky, the posterior margin long ciliated, the anal lobe but little produced, rounded; the veins pale and thin; the radius is somewhat brownish, its anterior branch is short, and runs into the costa near the middle of the wing; its posterior branch is nearly straight, the media curves towards the tip and runs into it, the cubitus forks somewhat distad of the crossvein, its posterior branch is suddenly deflected, the anterior branch and the main trunk are about of equal length. The middle and hind legs are distinctly pilose, the anterior metatarus is one half the length of its tibia. Length 1.5 mm. Greenland. Lundbeck, loc. cit.

9. Camptocladius velutinus Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.274, 54
1902 Camptocladius Kertesz. Cat'l. Dipt. 1:215

This species resembles C. byssinus and C. minimus, but differs from the former in having smoky wings and in being smaller; from the latter in having shorter metatarsi, and from each in its wing venation.

Female. Thorax black, velvety, with two indistinct longitudinal stripes, anteriorly confluent; the abdomen black, velvety, sparsely yellow, pilose; the scutellum brown. Antennae and palpi dark.

The legs black or blackish brown. The halteres are dark, peduncle and base of knob sometimes sordidly white. The wings gray or smoky, the anal lobe moderately produced into an obtuse angle; the veins are thin and pale, the radius is dark, R_{4+5} almost straight, the costa extends a little beyond the tip, the media runs into the tip of the wing, the fork of the cubitus is about opposite the crossvein, its posterior branch suddenly deflected. The middle and hind legs are very pilose, the fore metatarsus is about one half the length of its tibia. Length, 1.5 mm. Greenland. Lundbeck, loc. cit.

10. Camptocladius extremus Holmgren

1869 Chironomus Holmgr. K. Svensk. Vet. Akad. Handl. 8:5, 40
1898 Chironomus Lundb. Vidensk. Meddel. p.276, 56
1902 Camptocladius Kertesz. Cat'l. Dipt. 1:214
1865 Chironomus aterrimus Bohem. Öfv. K. Vet. Akad. Förh. p.575, 21, part

Male. Black, silky. Antennae fuscous black. Wings whitish hyaline, toward the costa subinfuscated; the halteres fuscous black, the legs the same color.

Female. Black, cinereous pruinose. The antennae pilose, the legs fuscous black. Wings somewhat cinereous toward the costa, subinfuscated. Halteres dark.

Male and female. Wings moderately wide, bare, the margins ciliated, the anterior veins stronger and darker than the others, which are pale and thin; there are two distinct spurious costal veins (folds?); a short subcostal vein is usually present. The fork of the cubitus is a little distad of the crossvein, Cu_2 much curved; R_{4+5} ends very near the tip of the wing. The legs of the male have longer pile than those of the female; in both sexes the tibiae and the tarsi of the fore and middle legs nearly bare. The fore tibiae rather long, straight, thickened at the base; fore metatarsus one half or at least one third shorter than its tibia. Length about 1.5 mm. Greenland. Holmgren, loc. cit.

This species is closely related to C. byssinus, but it differs in that the base of the fork of the cubitus lies under the crossvein or but little distad of it. Lundbeck, loc. cit.

Genus 41. Orthocladius Van der Wulp

Tijdschr. v. Entomol. XVI (LXX) and XVII, 132

The larvae and pupae greatly resemble those of Cricotopus, and I have been unable to find a single character which will separate all the species of the one genus from those of the other.

Imago. Resembles Cricotopus and Camptocladius. The fore metatarsus is shorter than the tibia; the legs are not black and white annulate, but nearly uniform in color, either dark or light, in the latter case at most with only dark articulations. Wings bare, R_1 enters the costa beyond the mid length of the wing; R_{4+5} straight or only slightly bent, reaching the end of the costa; crossvein at or even before the mid-length of the wing; the forking of the cubitus usually noticeably distad of the crossvein; the posterior branch straight or gently curved. Genitalia of the type shown on pl.33, fig.1, thus resembling Cricotopus (fig.2). The species usually small, though occasionally of moderate size. In other respects like Chironomus. It will be noted that it does not differ structurally from Cricotopus, differing only in color characters.

KEY TO SPECIES OF ORTHOCLADIUS

Larvae

a Mandible slender with sharp apex; antennae slender; margin of labium irregular, pl.24, fig.12.....5. flavus n. sp.

aa Mandible rather stout; margin of labium with regular teeth

b First laterals of the labium notched on the outer margin; mandible with lateral surface wrinkled.....15. fugax n. sp.

bb First laterals with rounded margins

c Labium on the lower surface with two converging folds, pl.25, fig.14 7. sordidellus

cc Labium without these folds, pl.24, fig.21.....8. nivoriundus

Pupae

a Posterior margin of each abdominal segment with a row of long stout setae, pl.24, figs. 15 and 16.....5. flavus n. sp.

aa The segments without these setae

b Dorsal surface of each segment nearly uniformly covered with minute spines and four pairs of setae; respiratory organ with enlarged apical end, pl.24, figs. 22, 23, 24.....8. nivoriundus

bb Dorsal surface with several transverse patches of minute spines

c The patch covering the center of the disk of each segment largest, pl.25, figs. 7 and 11.....15. fugax n. sp.

cc The middle band consists of two irregular rows of short stout spines 7. sordidellus

Imagines

a Yellowish species. (The females, and the species with brown abdomens, should be sought for in the next section also.)

b Large species 6 mm. in length; yellow; thorax with three dark yellow or brown stripes; abdomen with two brown spots on each segment; male.....1. par

bb Smaller species with pale or yellowish brown abdomen; if not, then abdomen is without distinct spots

c Thoracic stripes black

d Thorax yellow; three vittae on mesonotum, spot below each wing, the pectus and metanotum black, mesonotum highly polished, scutellum brownish yellow; legs brown, fore metatarsus three fourths as long as its tibia; length 2.5 mm.; abdomen pale brown; male. (District of Columbia) ..... 2. politus

dd Abdomen fuscous black; legs brownish; length 3 mm.; female. (See sordidellus also) ..... 3. frigidus

cc Thoracic stripes brown or reddish

d Abdomen of male with spots on sides of last two segments. Eastern species ..... 4. oceanicus

dd Abdomen not spotted

e Species having black tibiae and tarsi; length 3.5 to 4 mm. 5. flavus n. sp.

ee Tibiae and tarsi yellow or pale fuscous; smaller species

f Minute yellow species having the crossvein of the wing at the basal third; length .75 to 1 mm. ..... 6. sordens n. sp.

ff Larger species with the crossvein beyond the basal third of the wing; length 2 to 3 mm. ..... 7. sordidellus

aa Blackish or fuscous species

b Wings with an hourglass-shaped spot ..... 20. clepsydrus

bb Wings not so marked; halteres dark

c Wings slightly smoky in both sexes; for metatarsus over .6 as long as its tibia

d Fore legs of male long haired; thorax of female anteriorly with yellow spots ..... 19. barbicornis

dd Fore legs of male nearly bare; thorax of female blackish 8. nivoriundus

cc Wings of the male at least, milk white; fore metatarsus about one half as long as its tibia; larva terrestrial ... 9. stercorarius

bbb Wings not so marked; halteres white or pale

c Legs pale; thorax with three stripes, sometimes indistinct

d The fore metatarsus about one half as long as its tibia; hind tibiae and tarsi scarcely pubescent; length 1 to 1.3 mm. 10. atomarius

dd Fore metatarsus more than one half as long as its tibia

e Thorax yellow with three brown stripes; scutellum yellow, metathorax black; abdomen brownish, or sordidly yellow; legs pale yellow, tipped with black; wings white; length 2 to 4 mm. ..... 7. sordidellus

ee Usually smaller species (2.5 mm. or less) and otherwise not as above

f Fork of the cubitus under the crossvein

g Fore metatarsus a little shorter than its tibia; thorax, including scutellum and pleura, yellow, the three stripes, pectus and metanotum brown; abdomen fuscous, base and venter yellowish; length 2 to 2.25 mm. (Greenland) 11. difficilis

gg Fore metatarsus 0.6 as long as its tibia; female with a peculiar egg guide, pl.33, fig.7....12. absurdus n. sp.

ff Fork of cubitus distad of crossvein

g R_{4+5} enters the wing margin far proximad of tip of Cu_1; length 1.25 to 2 mm. (Greenland)....13. claripennis

gg R_{4+5} enters wing margin distad of Cu_1

h Small blackish species 1 to 1.5 mm. long; fore metatarsus a little shorter than its tibia.....14. minutus

hh Species 2 to 2.5 mm. long; greenish black; fore metatarsus a little over one half as long as its tibia 15. fugax n. sp.

cc Legs fuscous or black; thorax of male usually not striped; antennae black

d Small black species 1 to 1.5 mm. in length; fore metatarsus a little shorter than its tibia.....14. minutus

dd Larger species 2.5 to 3 mm. in length

e Fourth tarsal joint obcordate, shorter than the fifth. (For description see genus Thalassomyia).....platypus

ee Fourth tarsal joint linear

f Fore metatarsus at least three fourths as long as its tibia

g Anterior tarsi of the male densely hairy; wings white; veins fuscous at base; abdomen subshining black; length 3 mm. .....16. pubitarsis

gg Fore tarsi of the male nearly bare; last three abdominal segments with pale margins; thorax of the female striped. (Compare also sordidellus) 3. frigidus

ff Fore metatarsus not more than two thirds as long as its tibia

g Wings whitish hyaline, a little darker in the female; abdomen fuscous, with fuscous hairs 17. obumbratus n. sp.

gg Wings cinereous; abdomen velvet black with the margins of the segments shining black; fork of the cubitus under or but very slightly beyond the crossvein.....18. basalis

NOTE—Consult also the auxiliary key of Walker's species on p.198

1. Orthocladius par Coquillett

1901 Orthocladius Coq. Proc. U. S. Nat. Mus. 23:608

Male. Yellow, the antennae except the basal joint, apices of front femora, of their tibiae and of their first two tarsal joints, the whole of the remaining joints, also the last two on the other tarsi, brown; a pair of rather large black spots on abdominal segments two to eleven (sic.); mesonotum marked with three darker yellow vittae, hairs of antennae bright yellow, becoming brownish at their apices; front tarsi destitute of long hairs, the fourth joint more than one third as long as the first; wings bare, whitish hyaline, the portion in front of R_1 and R_{4+5} dark gray, the veins brownish; length 6 mm. Riverton, N. J. Coquillett, loc. cit.

2. Orthocladius politus Coquillett

1902 Orthocladius Coq. Proc. U. S. Nat. Mus. 25:93

Male. Head yellow, antennae brown, its hairs yellowish brown; thorax yellow, the three vittae on mesonotum, spot below each wing, the breast and metanotum black, mesonotum highly polished, scutellum brownish yellow, polished, its base opaque blackish; abdomen yellowish brown, becoming darker toward the apex; legs brown, trochanters and extreme bases of femora yellow, middle and hind tibiae and bases of their tarsi dull yellowish, legs only pubescent, fourth tarsal joint slender, as long as the fifth, first joint of front tarsi three fourths as long as the tibiae; wings hyaline, small crossvein not darker than the adjacent veins, R_{4+5} almost straight; halteres yellow; length, 2.5 mm. Washington D. C. Coquillett, loc. cit.; New Jersey, (Johnson).

3. Orthocladius frigidus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.812, 14
1850 Chironomus Zett. Dipt. Scand. 9:3516, 33
1872 Chironomus Holmgr. Öfv. K. Vet. Akad. Förh. 29:105
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20
1898 Chironomus Lundb. Vidensk. Meddel. p.279, 61
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:218

Male and female. Black, subopaque, dorsum of the thorax in the male with a testaceous margin; in the female testaceous with three separated black stripes; the wings cinereous hyaline; the antennae and the legs fuscous. Length 3 mm.

Black, somewhat opaque, and but slightly pubescent. The antennal hairs of the male fuscous black. The thorax pale fuscous underneath, the dorsum with three stripes; these in the male are dilated and confluent, in the female separated, black in color, as is also the metathorax; scutellum yellow. Abdomen of the male narrow, of the female more robust; in both sexes it is black, somewhat hairy; the last three segments with pale apical margins. Wings subhyaline, spotless, the crossvein and the radius subfuscous. Halteres white. The legs wholly fuscous black, tibiae and tarsi slightly paler; somewhat pubescent; fore metatarsus about one fourth shorter than its tibia; fore tarsi bare. Greenland (Staeger, Holmgren and Lundbeck).

According to Lundbeck (1898, p.280) the species which Staeger (1845, p.354) mentions is not O. frigidus but O. pubitarsis Zett.

4. Orthocladius (?) oceanicus Packard

1869 Chironomus Packard. Proc. and Commun. Essex Inst. 6:42
1878 Chironomus Ost. Sack. Cat'l. Dipt. p.21

Larva. It is pale whitish in color, the thoracic rings being tinged on their harder parts with green. It is .22 to .25 of an inch in length. The labium is somewhat triangular and multidentate on the anterior side. This larvae differs from fresh-water larvae of the same genus from Lake Champlain in not having the three-jointed filamentous appendages inserted just above the anal legs. The pair of anal legs is well-developed, and terminates in a single crown of hooks, which can be retracted entirely out of sight. In the fore legs the hooks are much more numerous and arranged in longitudinal rows, about twenty-five in number; those on the upper side of the tip being much the largest, those at the base being minute (pl.34, figs. 17, 18, 19).

Pupa. There are no thoracic filaments, nor is the abdomen terminated with hairs, but the genital armor is well-developed.

Imago, male. The antennae of the male are about as long as the thorax, arising from a knob-like basal joint; the joints are of even length, and from each one arises long delicate hairs, which in our specimens were somewhat appressed to the antennae. But we think it was due to the immaturity of the specimens, and that the hairs stand out as usual in the genus. The lingua is short; palpi well-developed, incurved; eyes large globose, prominent, black. The body is throughout pale testaceous; on the anterior half of the thorax is an oblong light brown spot and an irregular oval spot on each side of the posterior half of the thorax, extending to a point opposite the insertion of the wing. On the under side of the mesothorax is a broad, flattened, corneous area, the fore legs being widely separated from the two posterior pairs. The sides of the thorax are pale with a few dusky spots. The legs are long and very slender, the middle and hind tibiae and tarsi dusky. The wings are white, reaching when folded to the end of the third segment from the end of the body. The abdomen is dusky brown, paler at the tip, with a dusky spot on each side of the last two segments; on the under side is a faint greenish tinge. The tip is flattened, the anal forceps are large with the tip bent in, forming a V, and meeting on the median line of the body. Compared with what is evidently a true Chironomus from Labrador, and other species living in Massachusetts, the thorax of the present species is longer and less globular, the mesosternum presents a longer area, and the antennae are longer and slenderer. The wings are unspotted; there is no transverse costal veinlet at the base of the wing; the costal vein terminates beyond

the middle of the wing, and the first subcostal veinlet terminates on the outer third of the wing, differing in these characteristics from the more typical Chironomi. The abdominal hairs are also shorter.

Female. The female has short 7-jointed antennae, of which the terminal joint is nearly twice as long as the one next to it; they are slightly hairy. The female of our species differs from the other true Chironomi in the shorter and stouter antennae and shorter and smaller palpi. The eyes are much as usual, as is the size of the head in proportion to the thorax. Our female specimen was too incomplete for further description.

The larvae were dredged from Salem harbor. Packard, loc. cit.

The terminology of the wing veins given above is as was given by the author, and therefore does not conform to that used in the other descriptions.

5. Orthocladius flavus n. sp.

Larva. (Pl.24, figs.11 to 17) Yellowish; head yellowish brown; length about 10 mm. Head short, extreme apical margin of labium and posterior margin of head black. Antennae yellow, moderately long, about one fourth or one third the length of the head, slender; apical joints very short and slender (fig.12a). Labrum flap-like, with rounded margin and having a pair of widely separated short yellow setae, the lateral margin fringed. Its under surface (and epipharynx?) differs considerably from the usual type, consisting here of slender caudad projecting lobes and the usual pair of lateral arms with black apices (fig.14). The mandibles (fig.12 md) are yellow, slender, pointed, and only the tip and the teeth black. The inner membranous part has several setae on its cephalic margin. The maxillae (fig.12 mx) are yellow, broad, flattened, each with a short palpus and a number of papillae. At the basal articulation are two branched setae. The hypopharynx (fig.11) is horseshoe-shaped, with papillae on its free margin. The labium (fig.12 l) has several moderately long lateral teeth, several blunt short teeth nearer the central line, and two small sharp ones at the apex. The anterior feet are very short, the yellowish brown claws simple and quite numerous. The body is yellow, moderately stout, with a very few scattered, small, slender setae. Posterior feet are rather short, about as long as the last body segment, claws nearly black, each with two teeth; the outer one slender, curved, the inner one straight, stout, and about one third as long as the outer one, each foot with 16 to 20 claws. The four anal blood gills are as long as the feet, blunt, and white in color. The two dorsal papillae are

dark brown on the under surface and pale above, but little longer than wide, each with 7 or 8 long brown setae at apex.

The larva constructs an oval case (fig.17), about 16 mm. in length, the thick outer coat of which is gelatinous, transparent; the inner tube in which the larva lives is dark brownish green, owing to the material (Spirogyra, etc.) of which it is constructed. When it is disturbed the larva escapes from a hole at the end of the tube. Normally it keeps up a water circulation through the tube by the undulating motion of its body.

Pupa. The pupa resembles very much that of Thalassomyia fusca. It is dusky yellowish brown in color, the ventral surface somewhat lighter. The respiratory organs are slender, about one fifth as long as the thorax, the surface covered with distad projecting scales (fig.13). Upon the dorsal surface of the thorax are several pairs of short black setae. The dorsal surface of all abdominal segments is finely sprinkled with very minute, short, dark setae; the armature of the posterior margin of the seventh segment is shown in fig.15; the margins of the other segments resemble this arrangement, but the spines become gradually shorter cephalad so that on the first segment the spines are replaced by short tubercles. The anal fin is broad and somewhat rounded at the apex, with two pale slender setae near the apex, and with a margin of moderately long, pale, matted hairs (fig.16).

Imago, female. Yellow; antennae, palpi, metathorax, and legs excepting femora, black. Length 3.5 to 4 mm.

Head and proboscis yellow, the latter with black tip; occiput slightly infuscated, palpi deep brown, the basal joint and basal one half of second joint of antenna yellow, the remaining joints deep brown. Thorax deep yellow, with three deep brown lines, the middle one divided by a yellow hair line, a dark brown spot in front of base of wing; pleura and scutellum yellow, pectus and metanotum black. Upon the yellow field of the dorsum and upon the scutellum are several irregular rows of short black hairs. Abdomen pale yellowish brown, disk of each segment a little darker, the posterior margin dorsally with a narrow, ventrally with a wider, yellow fascia. Hairs black. Genitalia yellow and inconspicuous. Fore pair of coxae yellow, middle and hind pair fuscous; all legs black; flexor surface of all femora, except extreme tip, yellow. The extreme basal portion of extensor surface of all femora also yellow. Legs microscopically hairy, fore tibiae with one, and middle and hind tibiae each with two small black spurs; pulvilli and empodium present; fore metatarsus about 0.6 as long as its tibia. The hyaline wings are broad and long, extending beyond the tip of the abdomen, the veins distinct, the anterior

ones yellow, the posterior ones hyaline. Venation as shown in pl.30, fig.6. Halteres cream white; peduncle slightly darker. One specimen bred from larva taken from pond water July 2, Ithaca N. Y.

6. Orthocladius sordens n. sp.

(Pl.30, fig.5)

Female. Yellow; face, proboscis, palpi and antennae yellowish, the palpi and the antennae, except the basal joints, somewhat infuscated. Vertex brownish yellow. Thorax yellow with its three dorsal stripes, metathorax and the sternum reddish. Abdomen yellow, sometimes somewhat infuscated. Fore metatarsus about one third shorter than its tibia; legs yellow, tibiae and tarsi somewhat infuscated. Wings hyaline, anterior veins yellow, posterior one colorless; cubitus forks distad of the crossvein; crossvein at basal third of wing; venation as figured. Halteres yellow. Length $\frac{3}{4}$ to 1 mm. Several specimens, Ithaca N. Y. Two mutilated specimens from South Dakota may also belong here.

7. Orthocladius sordidellus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.814, 26
1850 Chironomus Zett. Dipt. Scand. 9:3521, 38
1864 Chironomus Schiner. Fauna Austr. 2:609
1874 Orthocladius V. d. Wulp. Tijd. v. Ent. 17:133
1877 Orthocladius V. d. Wulp. Dipt. Neerl. p.280, 6
1839 Chironomus variabilis Staeger. Kröjer: Naturh. Tids. 2:571, 44
1850 Chironomus Zett. Dipt. Scand. 9:3519, 36
1878 Chironomus Ost. Sack. Cat'l. Dipt. p.21
1898 Chironomus Lundb. Vidensk. Meddel. p.280, 63
1839 Chironomus varians Staeger. Kröjer's Tids. 2:573, 47
1850 Chironomus Zett. Dipt. Scand. 9:3546, 71

Larva. (Pl.25, figs. 12 to 15.) Yellowish green; head short, brown, with a number of delicate dorsal setae. Each eye consists of two nearly contiguous spots. Antennae (fig.13) short, about three fifths the length of the mandibles, brown in color with apex of each joint paler. Labrum blunt at apex, with a few short marginal papillae and apical setae (fig.12); epipharynx with the usual lateral arms, but the curved setae are very much reduced and modified. Mandibles stout, apical one half, sometimes wholly, black or dark brown, with a long, slender, lateral seta (fig.14 md). The maxilla (fig.14 mx) has a short palpus, some papillae, and a mesad-projecting tuft of pointed filaments; upon its ventral surface a pair of setae, and another larger pair upon the anterior margin of the ventral head sclerite below the base of the maxilla. The hypopharynx has three tufts of papillae upon its margin, one

median and the others lateral. The labium has rounded teeth, the first laterals as long as but not as wide as the middle one; the remaining laterals are more pointed. Viewed from the ventral surface two oblique folds or thickenings in the chitin, one on each side nearly parallel to the toothed margin, may be seen. The claws of the anterior prolegs are coarse and pectinate. The anal prolegs and appendages resemble those shown on pl.25, fig.6. The larvae were taken from a brook near Ithaca N. Y.

Pupa. Yellowish; length 3 to 3.5 mm. Respiratory organs very small. The marking on the dorsum of the abdominal segments (a side view of one is shown in fig.15) consists of four transverse rows on each of segments 2, 3, 4, and 5; and two rows on 1, 6, 7, and 8. The first transverse row on a segment consists of about two or three rows of extremely minute spines; the second an interrupted double row of short but stout spines; the third an irregular triple row near the posterior margin; all these pointing caudad; and finally in the fold of the incisure there is an irregular triple row of much smaller ones pointing cephalad. The second and last rows are wanting on segments 1, 6, 7, and 8. The caudal appendages are like those shown on pl.24, fig.3, for a species of Cricotopus. Larva and pupa have recently been described by Taylor (1903).

Imago. (Pl.30, fig.7) This species resembles Chironomus viridis, but differs in the generic characters. Dorsum of thorax with three dark brown stripes; the metathorax and sternum black; scutellum yellow; the abdomen brownish, the forceps small, the arms rather thick. Antennae, including the basal joints, brown; the hairs pale brownish; palpi brownish red. Legs pale yellow; the extreme tips of the tibiae black; the tarsi dusky; fore metatarsus one third or one fourth shorter than its tibia. Wings whitish. Halteres yellow. Length 2.75 to 4 mm. Greenland, New York, Washington, Texas, Illinois.

Zetterstedt's description of variabilis, which is considered a synonym of the above, is as follows:

Male. Antennae with dark hairs. Head blackish; palpi fuscous. Thorax subopaque, yellow or testaceous, with three black or brown stripes, often distinct, sometimes very wide subconfluent, covering nearly the whole of the dorsum, leaving the humeri pale. Sternum blackish; scutellum more or less yellow; metathorax black. Abdomen narrow, hairy, black, the venter yellowish or testaceous, after death often blackish. The caudal end black, the appendages leaf-like or narrow ovate. Wings white or cinereous hyaline, spotless; halteres pale yellow. Legs nearly bare, brown, fuscous or testaceous, the femur toward the tip often darker, the fore coxae yellow, the tarsi often fuscous, especially the fore pair.

The fore metatarsus about one fourth shorter than its tibia, and about one third longer than the next tarsal joint; tarsi bare. Length 2.5 to 3 mm.

Female. Differs from the male thus: The base of the antenna is often yellow, the thoracic stripes are always distinct, the yellow of the dorsum is usually conspicuous; the abdomen is stouter, less hairy, venter very often conspicuously yellow; the wings cinereous, the wing veins near the costal margin subtestaceous, and lastly, the body is stouter. Length 2 to 2.7 mm.

8. Orthocladius nivoriundus Fitch

1846 Chironomus Fitch. Winter insects of Eastern New York. p.274
1878 Chironomus Osten Sacken. Cat'l. Dipt. N. A. p.21
1898 Orthocladius Johnson. Cat'l. N. J. Dipt. p.627

I formerly erroneously regarded this species as a synonym of Diamesa waltlii.

Larva. (Pl.24, figs.18 to 24). The larvae were collected from pond water on March 28 and the flies emerged the following week. The larva is a pale green creature, somewhat infuscated on the dorsum. Length 6 mm. Head deep brown, short; antennae (fig.19) short, a little less than three fourths as long as the mandible, first joint three fifths of total length, apical appendage of the first joint as long as the second and third joints taken together. Each eye consists of a pair of spots separated by a fine line. Labrum with three pairs of moderate size and about three pairs of small setae on the lower surface; epipharynx with the usual arms and curved pectinate setae. The mandible is stout, with black toothed apex; the maxilla (fig.21 mx) has a small palpus, several plunt setae, some fine hairs and a bunch of mesad projecting, delicate, pointed filaments. The free margin of the labium is provided with black teeth, the middle one broad, with a rounded margin (fig.21 l). The dark thoracic prolegs have the usual slender hairs, but these are apparently either bifid or pectinate. The anal prolegs have sharp bilobed claws. The papillae of the anal hair tufts are short and dark brown in color. Caudad of these is a pair of prominent setae and on the ventral surface cephalad of the anal prolegs is another pair. The anal prolegs are of the usual form. The anal blood gills are present.

Pupa. Black or deep fuscous; abdomen paler. Length about 4 mm. The thoracic spiracles are slender, tubular, with a roughened surface (fig.23); length perhaps a little less than an abdominal segment. The dorsum of each segment, excepting the seventh and eighth, is nearly wholly covered with very short, microscopic spines, besides about four pairs of longer black setae as shown in fig. 22. Sometimes those near the caudal margin

are wanting, or replaced by others nearer the anterior pair. The lateral fins of the seventh and eighth segments have four or five pale, slender filaments; the caudal appendage is fringed with slender hairs, and there are three stout setae at each angle of the apex.

Imago, female. (Pl.30, fig.8) Grayish black. Length 2.5 to 3 mm. Wholly grayish or brownish black, including head with all its parts, thorax and abdomen. Legs pale brown; fore legs nearly wholly bare, middle and hind ones sparsely haired. Fore metatarsus about 0.6 as long as its tibia. Wings slightly smoky hyaline, anterior veins brown, posterior veins hyaline. Venation as shown in figure. Halteres dull black.

Male. Wholly black, very slightly shining. Thorax with a suggestion of three black dorsal stripes; the other parts dull. Abdomen with dark brown hairs. Antennal hairs, black. Legs, dark brown, or almost black, fore tarsi nearly bare. Anal angle of wing prominent; anterior veins brown, wings slighty cinereous. Genitalia black. Length 3.5 mm. In other respects like the female.

This species differs from s t e r c o r a r i u s in having smoky wings in both sexes, abdomen of female darker, and in having an aquatic larva. Ithaca N. Y. The following is a copy of Fitch's description.

Black; poisers obscure brown; wings pellucid-cinereous, their anterior nervures blackish. Length about .15 inch to the tip of the abdomen in the male—females one third shorter.

This species is black throughout, and clothed with fine black hairs. The thorax has three slightly elevated longitudinal ridges immediately forward of the scutel. The wings, when the insect is at rest, are held against the sides of the abdomen, often vertically in the males, but more commonly in the females with their inner margins in contact, thus forming a steep roof covering the back. They are diaphanous, of a cinereous tinge, and feebly irridescent. Their inner margins toward their bases are slightly arcuated. The submarginal or postcostal nervures—those which bound the closed basillary cell, and which proceed from this cell to the margin—are particularly obvious, being of a blackish color, excepting the nerve which proceeds from the inner angle of this cell to the apex of the wing, which, with the nervures inside of it, scarcely differ in color from the surface which they ramify. The poisers are obscure-brownish, truncated at their apices, the capitulum being in the form of a reversed triangle. The abdomen in the female is shorter than the wings, somewhat compressed, approaching to an ovate form when viewed laterally, with the venter

often of a dull brownish tinge; in the males it projects beyond the tips of the wings, is slender, cylindrical, or very slightly tapered towards the tip, with some of the terminal segments separated by a strong contraction.

This is a very common species, appearing upon the snow in the winter season, and upon fences, windows, etc., in the fore part of spring, the males and females being about equally numerous. The beautiful plumose antennae of the former distinguish them at a glance from all other insects abroad at this season. At times they may be met with in immense swarms.

Some specimens of larvae and adults from Gallinas river, Las Vegas N. M. (altitude 6400 feet), do not appear to differ excepting in being a little larger; the genitalia of the male resembles that of Diamesa waltlii. It is possible that on examination of more material the New Mexican form may prove to be a distinct species.

9. Orthocladius stercorarius Degeer

1776 Tipula Deg. Mem. pour serv. a l'hist. d. Ins. 6:388, 22
1818 Chironomus Meig. Syst. Beschr. 1:46, 57
1850 Chironomus Zett. Dipt. Scand. 9:3571, 97
1864 Chironomus Schiner. Fauna Austr. 2:612
1872 Chironomus Holmgr. Öfv. K. Vet. Akad. Förh. p.105
1874 Orthocladius V. d. Wulp. Tijds. v. Ent. 17:133
1877 Orthocladius V. d. Wulp. Dipt. Neerl. p.279, 2
1878 Chironomus Osten Sacken. Cat'l. Dipt. N. A. p.21
1898 Chironomus Lundb. Vidensk. Meddel. p.277, 58
1804 Chironomus chiopterus Meig. Klass. 1:17, 18

Wholly dull black; the antennae blackish brown, the hairs scarcely lighter. Forceps of the male black. Legs blackish brown, pitchy, or occasionally still paler; the fore legs bare; the fore metatarsus only one half as long as its tibia. Wings milky white. The halteres black or brown. The female has somewhat darker wing and lighter abdomen. Length 1.5 to 2.75 mm. Greenland. Holmgren and Lundbeck.

10. Orthocladius atomarius Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3522, 40
1864 Chironomus Schiner. Fauna Austr. 2:609
1884 Orthocladius Mik. Wien. Ent. Zeitg. 3:202
1898 Chironomus Lundb. Vidensk. Meddel. p.283, 68

Resembles O. sordidellus, but is much smaller and the structure of the tarsi is different. Thorax brown, subshining, the dorsum usually yellowish, light brown or testaceous, with three nearly confluent dark stripes; metathorax black. Abdomen

brown, venter lighter, genitalia small. Antennae and its hairs brown. Legs yellow or sordidly white, nearly bare; fore metatarsus only one half as long as its tibia; bare. Wings whitish, immaculate. Halteres white. Length 1 to 1.3 mm. Schiner, loc. cit. Greenland, Lundbeck. Ithaca, N. Y.

11. Orthocladius difficilis Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.282, 67
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:217

Male. Thorax yellow or reddish yellow, with three dark brown stripes, the median posteriorly, the lateral ones anteriorly abbreviated. Scutellum yellow, the metathorax brown, the pleura yellow, the sternum brown; abdomen fuscous black, yellow pilose, the base and the venter yellow. The antennae brown; the palpi sordidly yellow. Legs yellow; the tip of each of the tibiae blackish brown. Halteres yellow; wings almost hyaline, the anal lobe produced, right angled, rounded at the apex; the veins pale and thin, a little stronger and darker at the costal margin. R_{4+5} straight, and enters the margin of the wing a little distad of the Cu_1; the costa is not produced beyond the tip of the wing, the media is straight and enters the tip of the wing, the fork of the cubitus lies below the base of R_{4+5}, its upper branch is a little longer than the main trunk, the lower branch is lightly curved at the tip. The middle and hind pairs of legs are hairy or pilose, the fore metatarsus is a little shorter than the tibia.

Female. Is a little smaller than the male, and the base of the abdomen is but little or not at all yellow; in other respects like the male. Length of male and female 2 to 2.25 mm. Greenland, Lundbeck.

12. Orthocladius absurdus n. sp.

(Pl.30, fig.9; pl.31, fig.8; pl.33, fig.7)

Female. Yellowish brown, including the legs. Genitalia with peculiar clasper-like egg guides. Length 3 mm. Head yellowish brown, including proboscis, palpi and antennae, the basal joint of the last yellow; first joint disk-like, the incisure between the second and third not sharply marked, the seventh elongate (pl.31, fig.8). Thorax, including scutellum, pale yellowish brown; the three dorsal stripes, the metanotum, a spot on the pleura and the pectus darker brown. Abdomen yellowish with a greenish tinge, the dorsum of each segment brownish, except on both sides of each incisure narrowly pale yellow. Hairs pale and sparse. Genitalia with the usual lobes of the female, but in addition a pair of slender arms each with six or seven long setae at the extremity (pl.33, fig.7). Legs uniformly yellowish brown;

fore metatarsus about 0.6 as long as its tibia. Wings hyaline, veins yellow, rather distinct, the anterior veins quite stout (pl.30, fig.9). Halteres pale. One specimen, Ithaca N. Y.

At first I considered this specimen the male of a new genus owing to the peculiar clasper-like appendages of the extremity of the abdomen; but the robust form of the abdomen, the form of the genital lobes, and the antennae, lead me to believe that the specimen is a female.

13. Orthocladius claripennis Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.281, 66
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:217

Resembles O. minutus Zett., but its smaller size, the position of the fork of the cubitus, and the shortness of R_1, distinguishes it.

Male. Thorax fuscous black, with three indistinct black stripes (at least in dried specimens); scutellum brown. Abdomen more or less pale fuscous, with yellow pile. The antennae reddish brown; the palpi yellow. Legs slender, yellow, the tibiae blackish brown at the tip. The halteres white; the wings hyaline and the anal lobe moderately produced, obtuse-angled, the veins slender and pale; R_{4+5} is short, and enters the margin of the wing far proximad of the tip of Cu_1; the media is almost straight, and runs into the tip of the wing; the fork of the cubitus is a little distad of the base of R_{4+5}, its lower branch is almost straight, only at the tip is it curved. The middle and hind legs are pilose; the fore metatarsus is a little shorter than its tibia.

Female. Is shorter and paler than the male, thorax yellow, with three brown stripes, the middle one posteriorly, the two lateral ones anteriorly abbreviated, and the scutellum is yellow; in other respects like the male. Length, male and female, 1.25 to 2 mm. Greenland. Lundbeck, loc. cit.

14. Orthocladius minutus Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3522, 39
1864 Chironomus Schiner. Fauna Austr. 2:609
1884 Orthocladius Mik. Wien. Ent. Zeitg. 3:202
1898 Chironomus Lundb. Vidensk. Meddel. p.281, 65
1898 Orthocladius var. plasensis Strobl. Glasnik Zem. Mus. Bosni i Hercegov. 10:613

Black, or blackish brown, somewhat shining, the last abdominal segment wider than the one preceding it; the forceps small. The antennae, including its hairs, brown. Legs yellowish brown,

the femora somewhat darker; the fore tarsi of the male bare or nearly so, fore metatarsus somewhat shorter than the tibia, the hind tibiae and tarsi thickly haired; wings whitish, spotless. Halteres white. The female has a light spot on each humerus, and the posterior legs have fewer hairs. Length 1 to 1.5 mm. Greenland. Lundbeck.

15. Orthocladius fugax n. sp.

Larva. In little rolls or tubes of debris upon the flat rock bottom of Cascadilla creek (Ithaca N. Y.) little bluish green larvae with dark brown heads were found. These larvae are rather more robust than those of many Chironomids, the middle body segments being fully as wide as they are long. The total length of a full-grown larva is from 3 to 4 mm. Head dark brown, short, with the suture separating the dorsal from the lateral sclerites quite distinct, the dorsal sclerite being elongate-oval, acute-angled at its caudal margin, with three setae upon each lateral margin, the most posterior of these being cephalad of the middle transverse line; opposite this last seta near the suture but upon the lateral sclerite is another seta a little caudad of this, also near the suture there is still another, and on each side near the ventral surface, directly ventrad of the paired eye spot, there is a pair. The pale brown antennae (pl.25, fig.3a) are short, only about one half as long as the mandibles. The latter is stout, its apical half blackened, and with a stout seta on its side. The labrum (fig.3) has a somewhat blunt apex with a few small setae; the epipharynx has the usual pair of arms the ends of which are not conspicuously darkened. The maxilla (fig.2 mx) has a short palpus and a few papillae and a group of mesad projecting filaments. The labium is brown, has a deep margin of black, the middle tooth is rounded, the first lateral has a more or less distinct notch on its lateral edge, the remaining laterals have rounded tips (fig.2 l). Each anterior proleg is provided with perhaps about 50 long and rather coarse pectinate setae (fig.5) and many shorter ones. The posterior legs are each provided with a number of claws, those on the periphery as shown on pl.25, fig.9, those in the middle of the foot as shown in fig.8. The papillae upon which the caudal setae are placed are short and pale in color. The anal blood gills are rather long and prominent (pl.25, fig.6). The diameter of the anterior abdominal segments is considerably greater than that of the posterior.

Pupa. Dark fuscous green. Length 2.5 to 3 mm. Respiratory organ slender, broadened toward the apex, its surface roughened (pl.25, fig.4); its length a little greater than the setae at the

caudal end. A side view of the markings of the second, third and fourth segments is shown on pl.25, fig.7; a dorsal view is given in fig.11. On the sixth, seventh and eighth segments the markings are less conspicuous. The microscopic spines, though short, are rather coarser than in allied species. Besides these spines there is usually on each segment a pair of small setae. The caudal appendage consists of the usual genital sacks and six setae, three on each side of the apex.

Imago. (Pl.30, fig.10.) Greenish black; thorax brown; length 2 to 2.5 mm.

Male. Eyes hairy; head deep brown, face between the bases of the antennae yellowish; proboscis, palpi and antennae pale fuscous, the basal joint of the last deep brown; antennal hairs brownish. Palpus with the first joint about as long as broad, second and third about twice as long as broad, fourth about 1.5 times as long as the second. Dorsum of the thorax and the scutellum dusky greenish yellow, the three stripes of the former and the metathorax deep brown. The pleura and the sternum are somewhat paler in color. Sometimes the scutellum and the space between the dorsal thoracic stripes are pale brown. The dorsal surface of the abdomen is velvet black with a slightly greenish tinge, the first segment wholly and the ventral surface of most of the succeeding segments green, posterior margins of each segment subshining black; the venter of the apical segments blackish. Genitalia pure white, similar to that of Cricotopus shown on pl.24, fig.10. Upon both the dorsal and ventral surface of each abdominal segment there are two irregular transverse rows of black setae, most numerous on the seventh and eighth segments. These are best seen in a balsam mount. Legs, including coxae, sordidly yellow, the knees sometimes widely, and tips of tibiae slightly darkened, moderately hairy; apex of fore tibiae each with one, middle with two short equal spurs; the posterior tibiae each with one long curved spur, one short one, and a row of slender apical setae. The empodium, at least of the hind feet, is curved and pectinate. The wings are hyaline, the veins distinct, pale fuscous, crossvein not clouded; costa with black setae; venation as figured. Halteres pale.

Female. Like the male, differing only in sexual characters; i. e. the more robust abdomen, form of genitalia etc. In both sexes the fore metatarsus is about 0.6 as long as its tibia. The green of the first abdominal segment is not always distinctly visible.

Var. a. Like the foregoing, but with the abdomen, usually including the venter dull fuscous or brown. Numerous specimens. Ithaca N.Y., Chicago Ill.

16. Orthocladius pubitarsis Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.811, 11
1850 Chironomus Zett. Dipt. Scand. 9:3514, 30
1898 Chironomus Lundb. Vidensk. Meddel. p.280, 62
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:221
1845 Chironomus frigidus Staeger (nec Zett.). Kröjer: Naturh. Tids. 1:351, 4

Blackish, subopaque, dorsum of thorax with three black stripes; antennae dark, wings white, legs fuscous testaceous, the fore metatarsus nearly as long as its tibia, fore tarsi of the male distinctly pilose; genitalia small, the appendages somewhat leaf-like. Length of the male 3.5 mm.; of the female 3 mm.

Male and female. The fore metatarsus nearly as long as the tibia, male genitalia subovate, and the densely pilose fore tarsi in the male distinguishes this species.

The head, antennae, and palpi blackish. The thorax blackish, or dull cinereous, subopaque, with black stripes. Scutellum and metathorax blackish. Abdomen of the male slender, linear, subopaque, black, fuscous pilose, the incisures narrowly whitish, subshining, the anal appendage short, subovate, black; of the female stouter, blackish, pubescent. Legs of the male fuscous testaceous, the middle and hind legs pubescent; the fore femora and tibiae bare, fore tarsi distinctly and densely pilose; in the female paler, the articulations narrowly blackish. The fore metatarsus nearly as long as the tibia, the second tarsal joint about one half as long. Halteres pale. Zetterstedt, loc. cit. Greenland, Lundbeck.

17. Orthocladius obumbratus n. sp.

(Pl.30, fig.11)

Male. Grayish black. Face yellowish, eye margin, occiput, antennae excepting the second joint, black; antennal hairs brownish or blackish, proboscis and palpi fuscous. Thorax opaque, grayish pruinose, the humeri and the anterior margin sometimes indistinctly yellowish, scutellum brown or yellowish brown. Abdomen fuscous with fuscous hairs, genitalia small. Legs fuscous, or subfuscous, middle and hind legs hairy; the trochanters and extreme bases of femora yellow; fore metatarsus about two thirds as long as its tibia. Wings whitish hyaline, anterior veins pale yellowish, posterior veins colorless, crossvein not clouded; R_{4+5} almost straight beyond its middle, bowing only a very little toward the costa; venation as figured. Halteres pale yellow.

Female. Somewhat paler than the male; the dorsum of the thorax has three wide blackish stripes, the space between them

and the humeri yellowish. Abdomen blackish or brownish, venter sometimes yellowish. Wings darker than those of the male, the anterior veins dark, R_{4+5} slightly bowed toward the costa beyond its middle. In other respects like the male. Length, male and female, 2.5 to 3 mm.

In immature specimens the legs and particularly the femora are pale. The paler female specimens resemble pubitarsis; the male differs in having no pale margins on the posterior abdominal segments.

Numerous specimens, Ithaca N. Y. Douglass, Alaska.

18. Orthocladius basalis Staeger

1845 Chironomus Staeger. Kröjer: Naturh. Tids. n. s. 1:351, 6
1872 Chironomus Holmgr. Öfv. K. Vet. Akad. Förh. 29:105
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20.
1898 Chironomus Lundb. Vidensk. Meddel. p.279, 60
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:216.
1869 Chironomus pavidus Holmgr. K. Svensk. Vet. Akad. Handl. 8:5, 42

The following is Holmgren's description of pavidus:

Male. Antennae a little shorter than the thorax, with fuscous black hairs; the joints somewhat separated. Thorax smooth and wholly shining, excepting the scutellum and metanotum; mesothorax with three stripes, the middle one produced anteriorly, and depressed posteriorly in front of the scutellum, with three short projecting points; scutellum obtuse, elevated and pilose. Abdomen black, subopaque, pale haired, the first segment wholly, the posterior margins of the others shining. Wings narrow, cinereous white or slightly smoky, darker along the costa; crossvein straight; subcosta slightly curved, extending to about the middle of the wing, with two distinctly spurious veins (folds?); fork of the cubitus but little distad of the crossvein. Halteres white or yellowish. Legs black fuscous, the middle of tibiae or before the base very frequently paler; the middle and hind legs sparsely haired; the fore tibiae and tarsi very short haired; fore metatarsus about one third shorter than the tibia. Length 3 mm.

Staeger's description of basalis is as follows:

Female. Head black, front shining. Thorax with humeri and pleura in front of base of wings yellowish, the dorsum with three confluent black stripes; the sternum grayish black. The coxae shining black. Abdomen velvet black, the first two segments yellowish brown (in fresh specimens perhaps pure yellow), and the posterior margins of the following segments shining black. The wings are somewhat darkened; the anterior veins and the crossveins are dark brown and prominent, the other veins are

indistinct; the subcostal vein ends proximad of the fork of the cubitus. The color of the legs is pitchy brown, the base of the fore femora and the middle of the hind tibiae are somewhat yellowish; the fore metatarsus is about one half as long as its tibia, the second tarsal joint is one half as long as the first.

Lundbeck (1898) compared Holmgren's and Staeger's types and declared them identical. Greenland, Washington State.

19. Orthocladius barbicornis Linne

1767 Tipula Linne. Syst. Nat. Ed. XII, 2:974, 25
1805 Chironomus Fabr. Syst. Antl. p.42, 20
1818 Ceratopogon Meig. Syst. Beschr. 1:71, 4
1864 Chironomus Schiner. Fauna Austr. 2:612
1884 Orthocladius Mik. Wien. Ent. Zeitg. 3:202
1805 Chironomus obscurus Fabr. Syst. Antl. p.40, 11
1818 Chironomus Meig. Syst. Beschr. 1:47, 60
1850 Chironomus Zett. Dipt. Scand. 9:3568

Male. Black, or deep fuscous. Head including palpi and antennae black, the hairs of the latter somewhat paler. Thorax with scutellum and metanotum black. Abdomen slender, black, hairy, incisures scarcely paler; caudal appendages short oval, black. Wings white (pale brownish yellow by reflected light), anterior veins testaceous. Halteres blackish. Legs black or pitchy, occasionally paler, uniformly and distinctly hairy; fore femora and tibiae with long, the tarsi with short hairs. Fore metatarsus one fourth to one third shorter than its tibia; the other joints gradually diminishing in length. Length 4 mm. (Zetterstedt in part.)

Female. Thorax anteriorly with yellowish or yellowish brown spots, representing the remains of a pale ground color; the halteres are paler; the wings darker. (Schiner.)

Some specimens from St. Paul Minn., and from Washington State do not differ from my European specimens.

20. Orthocladius clepsydrus Coquillett

1902 Orthocladius Coq. U. S. Nat. Museum Proc. 25:92

Female. Black, the extreme bases of femora and of front tibiae, also the other tibiae except their apices, whitish; mesonotum polished, scutellum and dorsum of abdomen opaque, velvet-like; wings hyaline, each marked with an hourglass-shaped black spot extending from one fourth length of wing almost to apex of upper branch of fifth vein (Cu_1), the constricted portion lying above the forking of the fifth vein (cubitus), the basal expanded portion reaching from fourth vein (media) nearly to hind margin of wing, the apical extending from third vein (R_{4+5}) almost to hind margin

of wing; legs only pubescent, first joint of front tarsi about half as long as the tibiae, fourth tarsal joint rather slender and almost as long as the fifth; length 1.5 mm. Las Vegas Hot Springs, New Mexico. (Coquillett, loc. cit.)

Genus 42. Tanytarsus Van der Wulp

Tijdschr. v. Entomol. XVI (LXX) and XVII, 134

Larva. Small species resembling Chironomus, occasionally red in color, though more often yellowish. Distinguished from allied genera by their long antennae with elongated apical joints, and the frontal protuberances upon which the antennae are mounted. The epipharynx and its appendages resembles that of Chironomus (pl.25, fig.16, and pl.26, fig.14); the maxilla has upon its inner angle one or more spine-like blades which project mesad and cephalad (pl.26, fig.12 mx); the thoracic segments frequently have a few short setae. The ventral surface of the eleventh abdominal segment apparently lacks blood gills.

Pupa. The thorax has a pair of respiratory organs, each of which consists of a central shaft with lateral filaments (pl.26, fig.3). The dorsal surface of the abdominal segments is characteristically marked with hairs and setae (pl.25, figs. 18 and 20, and pl.26, fig.11). The eighth segment has a comb at the caudal end of each lateral fin, and the anal segment has a fringe of hairs forming a paddle (pl.26, figs. 6 and 15).

Imago. (Pl.30, figs. 14 to 21) Antennae of male 14-jointed, long plumose; antennae of female 7-jointed, sparsely haired, first joint in both sexes large and disk-like. Palpi bent, 4-jointed, the last joint usually a little longer than the preceding. The eyes reniform, ocelli wanting. Thorax highly arched, projecting somewhat over the head; metanotum arched. Abdomen of the male slender, the anal segment distinctly separated from the preceding; genitalia long and slender; abdomen of the female shorter and stouter. Legs slender, fore tarsi elongated, the fore metatarsus longer than its tibia; hind legs usually hairy. Wings distinctly hairy; anal angle small; crossvein upon or even proximad of the mid length of the wing; R_{4+5} joins the margin at the extremity of the costa; media simple; the forking of the cubitus is under or just distad of the crossvein; the lower branch is straight or gently bent downwards. Species rather small.

KEY TO SPECIES OF TANYTARSUS

Larvae

a Moderate sized pink or red species, with long filaments at the extremity of antenna, pl.26, fig.1a

b With a hump on dorsal surface of last abdominal segment, most distinct in fresh specimens, pl.26, fig.5.....5. dives n. sp.

bb Without this hump.....3. gmundensis

aa Small yellowish species, antennae without long filaments

b Antennae with two delicate processes with slightly enlarged ends at extremity of the second joint, pl.26, figs. 13–14; larva usually found in its fibrous case, pl.26, fig.9.....13. exiguus n. sp.

bb Antenna with a pointed process at end of second joint, pl.25, figs. 16, 17.....10. dissimilis n. sp.

Pupae

a Lateral fin of the eighth abdominal segment with a simple terminal spur, pl.26, fig.15; second abdominal segment with two small patches of setae near the anterior end and a transverse row near posterior end; pupa in a fibrous case, pl.26, fig.9.....13. exiguus n. sp.

aa Lateral fin of the eighth segment with a comb

b Fourth abdominal segment with two patches of short stout setae on anterior end and a few scattered setae on the surface, pl.26, fig.7

5. dives n. sp.

bb Fourth segment with two longitudinal rows of setae caudad of the anterior patch

c With a transverse row of stout setae on posterior margin of third segment, pl.25, fig.20.....10. dissimilis n. sp.

cc With two patches of setae near posterior margin of the third segment, pl.25, fig.18.....Var. a. of dissimilis

Imagines

a Thorax uniformly black or brown; thoracic stripes wanting or very indistinct

b Legs white or pale yellow; wings white; thorax and abdomen subshining black; male abdominal segments with paler posterior margins; fore metatarsus about 0.15 longer than its tibia

1. obediens n. sp.

bb Legs dusky yellow, fuscous, or black

c Halteres black or dusky; thorax and abdomen subshining black; fore metatarsus about 0.16 longer than its tibia

2. nigripilus n. sp.

cc Halteres pale

d Fuscous, including legs; thorax subshining; fore metatarsus over 0.4 longer than its tibia.....3. gmundensis

dd Smaller dark brown or fuscous green species; fore metatarsus less than one fourth longer than its tibia

4. deflectus n. sp.

aa Thorax green or yellow; if darker, then with distinct stripes
b Dark brown or greenish species, thoracic stripes, usually dark
c Brownish species
d Two mm. or less in length; fore metatarsus but little longer than its tibia.....4. d e f l e c t u s n. sp.
dd Three mm. or more in length
e Yellowish brown thorax with brownish stripes; fore metatarsus 1.5 times as long as its tibia.....5. d i v e s
ee Fore metatarsus 1.3 times as long as its tibia.....6. T. sp.
cc Greenish species
d Crossvein nearly in the middle of the wing; length 2.5 to 3 mm.; dark green species.....7. j u n c i
dd Crossvein noticeably before the middle of the wing
e Fore metatarsus twice as long as its tibia.....8. p u s i o
ee Metatarsus of fore legs not twice as long as its tibia
f With dark brown thoracic stripes; length 2 to 3 mm. 9. f a t i g a n s n. sp.
ff With yellowish or brown thoracic stripes; length 1.25 to 1.75 mm. .....10. d i s s i m i l i s n. sp.
bb Yellow species; thoracic stripes when present, pale or reddish
c Testaceous; abdomen brown, segments with slightly paler margins; fore metatarsus one fourth longer than its tibia 11. f u l v e s c e n s n. sp.
cc With yellowish green, or green abdomen
d Fore metatarsus not more than one half longer than its tibia
e Fore metatarsus one half longer than its tibia; yellowish green species, more or less dusky.....10. d i s s i m i l i s n. sp.
ee Fore metatarsus one third longer than its tibia; paler species; length 2.5 to 3 mm.....12. m u t i c u s n. sp.
dd Fore metatarsus more than 0.7 longer than its tibia
e Species 2 mm. or more in length; fore metatarsus twice as long as its tibia.....14. t e n u i s
ee Species less than 2 mm. in length
f Fore metatarsus about three fourths longer than its tibia 13. e x i g u u s n. sp.
ff Fore metatarsus about 2.5 times as long as its tibia 15. f l a v e l l u s

1. Tanytarsus obediens n. sp.

(Pl.30, fig.14)

Male. Subshining black; wings and legs cream white. Head black, palpi, proboscis and antennae with its hairs fuscous, the basal joint of the last yellowish. Thorax subshining black, humeri sometimes slightly yellowish and dorsum with faint indications of two narrow cinereous lines, and three lines of yellow hairs. Abdomen black, the posterior margins of all the segments white or yellow; hairs yellowish; genitalia elongate, yellow. Coxae brown; legs cream white, with white hairs; middle and hind tibiae each with a minute black comb at the tip; fore tarsi

very short-haired, fore metatarsus about one sixth longer than its tibia. Wings cream white, with white veins; venation as figured. Halteres white.

Female. Like the male but with yellow antennae, and the abdomen is nearly uniform in color, paler margins at most but feebly indicated. Length, both sexes, 3.5 to 4.5 mm.

In one male specimen the abdomen is wholly black, and the basal joint of the antenna brown. This fly greatly resembles the female of Chironomus nigricans n. sp., from which it may readily be distinguished by its hairy wings. Numerous specimens; Ithaca N. Y., May, June, July. Washington State.

2. Tanytarsus nigripilus n. sp.

Resembles T. sylvaticus V. d. W., an European species, but differs in having black halteres.

Male. Black, subshining; length 3.5 to 4 mm. Head black; palpi, proboscis and antennae also black, the last with blackish hairs. Thorax wholly subshining black, the dorsum when viewed obliquely from in front with two more distinctly shining black stripes. Abdomen black, subshining, incisures faintly cinereous, hairs black. Claspers slender, brownish. Coxae and legs black, long-haired, particularly the fore tarsi, which are almost bearded; fore metatarsus about one sixth longer than its tibia. Wings hyaline, slightly brownish tinted, anterior veins brownish, posterior ones pale; cubitus forks about under the crossvein. Halteres fuscous or black.

Female. Like the male, but the fore tarsi are less hairy and the halteres are paler. Ithaca N. Y., April. Washington State.

3. Tanytarsus gmundensis Egger

1863 Chironomus Egg. Verh. z. b. Ges. Wien. 13:1109
1864 Chironomus Schiner. Fauna Austr. 2:597, 7
1874 Tanytarsus V. d. Wulp. Tijd. v. Ent. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p.285

(Pl.30, fig.15)

Male. Fuscous. Head, including palpi, proboscis and antennae fuscous, the last with fuscous hairs. Thorax and abdomen wholly fuscous, the last with yellowish hairs; genitalia brown. Legs fuscous, trochanters and bases of femora yellow; short-haired. Fore metatarsus about 1.5 times as long as its tibia. Wings hyaline, veins near the anterior margin yellowish, and others paler. Halteres yellow.

Female. Like the male but with broader wings. Length 3 to 4 mm. I cannot distinguish the American from my European specimens. Ithaca N. Y., Chicago Ill., Washington State. April and October.

4. Tanytarsus deflectus n. sp.

(Pl.30, fig.16)

Female. Brown; abdomen paler. Head, including palpi and antennae brown, second and third joints of the antenna more or less coalescent; rostrum with prominent black setae. Thorax including pleura, pectus, and metanotum, brown; the first with three darker brown stripes; scutellum a little paler. Dorsum of thorax with dark setae. Abdomen uniformly yellowish brown, with black hairs. Legs, including coxae, brownish yellow, the knees slightly darker; quite hairy; fore metatarsus about one fifth longer than its tibia. Wings very hairy, anal lobe not prominent. Halteres white. Length 1.5 to 2 mm.

The respiratory organs of the pupa consist of two slender more or less cylindrical processes armed with one lateral seta at about one third from the apex, and with two or three shorter ones on the apex (pl.22, fig.6). The pupal skin is so mutilated that a further description cannot be given. Several captured and one bred specimen. Ithaca N. Y.

5. Tanytarsus dives n. sp.

Larva. The larvae were found in the sand at the bottom of a pool of water, drainings from a pile of manure. Blood red, with a greenish tinge on the sides, and a prominent hump on the anterior part of the dorsum of the last segment (pl.26, fig.5). Length 6 to 7 mm. Head dark, about 1½ times as long as wide, antennae much elongated, about two thirds as long as the head, or fully as long when they are measured to the tips of the two long filaments of the second antennal segment (pl.26, fig.1). The first joint long and slender, with a slender seta on its side, and a spur at the tip near the base of the second segment; second segment about three times as long as wide, with two long slender filaments at the tip near base of third segment. The third and fourth segments slender, delicate, and inconspicuous; these two taken together less than the length of the second joint. The dorsal sclerite of the head not distinctly separated from the laterals. Upon the dorsal aspect of the head are eight pairs of rather long setae, arranged as shown in fig.1. Each antenna is mounted upon a frontal prominence. There are two distinctly separated eye spots upon each side of the head. The labrum is rather more prominent than usual with Chironomus, with five or six pairs of conspicuous curved subapical setae, a pair of pectinate hairs, several pairs of smaller setae, and an apical pair of short, jointed papillae. The epipharynx resembles that of Chironomus, with its horseshoe shaped ridges, the curved,

overhanging setae, and the transverse comb, the latter having a number of uniform rather long, slender, caudad projecting teeth. Caudad of this are three hand-shaped processes, each with five or six slender, apical, finger-like projections. The lateral arms are prominent, and have enlarged, bifid extemities. Each mandible has a stout subapical and mesad projecting seta, a fringe of subapical hairs, and a slender dorsal, laterad projecting seta (fig.2). The maxilla (fig.4 mx) has a comparatively long palpus (p), a number of small papillae and setae and some mesad curved spines. The hypopharynx has the usual fringe of fine hairs and papillae (fig.4 hy). The labium (l) has about 13 blunt, rounded teeth, the middle one most prominent.

The anterior prolegs have numerous curved, slender, hair-like setae. In nearly mature specimens the thorax is somewhat enlarged. The body has few if any setae. The last segment (fig.5), has a prominent hump near the anterior margin; the posterior prolegs are rather prominent, with a small number of stout claws; each of the dorso-caudal setae tufts is mounted on a prominence. The anal gills are four in number and comparatively short, about twice as long as wide. The larva makes a rough, loose, cylindrical case which partly conceals it.

Pupa. Length 4 to 5 mm. Dusky, with the thoracic respiratory organs each consisting of a single slender shaft, with lateral hairs (fig.3), about as long as a single abdominal segment. The dorsal surface of the abdomen is marked with minute setae, spines, and hairs, as shown in fig.7. This figure shows segments two to six inclusive. The dorsum of the second segment is nearly uniformly covered with fine, very short, miscroscopic spines, four or five pairs of pale setae and the usual chitinous, longitudinally ridged, posterior margin; the third has anteriorly two patches of short black spines, two patches of fine hairs, the rest of its dorsal surface punctate with minute spines, and five or six pairs of pale setae; the fourth, fifth and sixth segments each have two dense patches of short black spines near the anterior margin, sparsely punctate with minute spines, and provided respectively with about eight, seven and five pairs of pale setae. The eighth segment (fig.6) has the usual lateral fins, with its filaments, and has also the combs, each with five or six prominent black teeth. The caudal fin is fringed with long, pale, matted hairs.

Imago, male. Dusky brown, sometimes blackish, legs yellowish brown; length 3.5 to 4 mm. Head, palpi, proboscis and antennae brown, the hairs of the last also brown. Dorsum of thorax gray pruinose, with three subshining brown or black stripes, humeri sometimes a little yellowish. The pleura, sternum and metanotum subshining black, the last with a narrow longi-

tudinal groove; scutellum sordidly yellow or brownish. Abdomen subshining, fuscous, the sides and venter a little paler, the last two or three segments and sometimes the lateral margins of some of the others black; posterior margins of all the segments slightly paler than the rest of the surface. Genitalia brownish, conspicuous, with four pairs of appendages, the outer pair elongate (pl.33, fig.5). All hairs reddish brown. Coxae dark, legs pale brown, extreme tips of middle and hind tibiae black, fore tarsi moderately hairy, middle and hind legs with long but delicate pale brown hairs. Fore metatarsus over 0.4 longer than its tibia. Wings hyaline, costal margin very slightly yellowish, anterior veins pale yellowish, hairs dusky (pl.30, fig.17). Halteres pale.

Female. Like the male but shorter; antennae yellow; wings more densely hairy, and wider in proportion to its length. Length of male 4 mm., of female 2.5 mm. Ithaca N. Y.

6. Tanytarsus sp.

Pupa. Respiratory tubes are very delicate and transparent, each apparently consists of about six long slender filaments resembling those of a Simulium pupa, but they appear to be jointed. The dorsal markings of each abdominal segment consist of an anterior and posterior transverse band of moderately coarse, short spines, a central area of very minute spines, arranged as shown on pl.22, fig.13. The lateral fins of the eighth segment terminate in a spiny spur as shown on pl.22, fig.17. The caudal fringe is as usual.

Imago, male. Head yellowish, including proboscis, palpi, and antennae, the basal joint of the last brown. Thorax reddish brown; the narrow space between the three wide brown dorsal stripes and the scutellum yellowish. Abdomen pale brown, venter more yellowish excepting toward the extremity. Incisures but little if any paler, genitalia and the abdominal hairs pale. Legs, including the apical half of the coxae, whitish, the tip of each middle and hind tibia with a minute black circular comb, one tooth of which is prolonged into a spur. Fore metatarsus about one third longer than its tibia. Wings hyaline, with a slight milky tinge, hairs pale, veins colorless. Halteres pale. Length 3.5 to 4.5 mm.

Female. Like the male but abdomen more brownish. Saranac Inn N. Y.

7. Tanytarsus junci Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:50, 68
1874 Tanytarsus V. d. Wulp. Tijd. v. Ent. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p.287, 9
1898 Chironomus Lundb. Vidensk. Meddel. p.283, 69

1839 Chironomus vernus Staeger (nec Meig.). Kröj. Nat. Tids. 2:580, 70
1850 Chironomus Zett. Dipt. Scand. 9:3579, 108
1864 Chironomus Schiner. Fauna Austr. 2:597

Antennae and palpi brown; antennal hairs of the male pale brown. Thorax dark green, with three broad, black, longitudinal stripes; the sternum and the metanotum shining black. Abdomen dark olive green; the anal segments of the male rounded, shorter and a little broader than the preceding; the claspers as long as the anal segment, broad in the middle, at the base and at the extremity somewhat narrowed; the abdomen of the female is much darker, almost black. Legs variable, blackish brown to yellowish brown; the forelegs long and slender, the fore metatarsus almost twice as long as the tibia (ratio about 4:7); the second tarsal joint about one half as long as the metatarsus; the following joints gradually decreasing in length; hairs of the legs dense and light brown in color. Halteres whitish. Wings hyaline, appearing grayish owing to its hairs; crossvein a little proximad of the mid length of the wing; the fork of the cubitus directly below the crossvein. Male, length 3 to 3.5 mm; female, 2.5 mm. Translation from V. d. Wulp, loc. cit. Greenland. Lundbeck.

8. Tanytarsus pusio Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:256, 117
1850 Chironomus Zett. Dipt. Scand. 9:3583, 115
1864 Chironomus? Schiner. Fauna Austr. 2:597
1874 Tanytarsus V. d. Wulp. Tijd. v. Entom. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p.287, 8

Male. Greenish; thorax with three dark stripes. Head greenish, palpi subfuscous, proboscis yellowish; large basal joint of antenna fuscous, the next few joints yellow, the remaining ones dark; hairs subfuscous. Thorax green with three dorsal stripes, the sternum and the metanotum blackish. Abdomen green, darker toward the caudal end; hairs pale; genitalia prominent, yellowish. Legs greenish yellow, the tarsi and the fore femora and tibiae slightly infuscated, middle and hind legs hairy. Fore metatarsus nearly twice as long as its tibia. Wings hyaline, hairy, veins pale, crossvein proximad of the mid length of the wing; fork of cubitus distad of crossvein. Halteres greenish yellow. Length 2 to 3 mm.

Female. The thoracic stripes reddish or brownish, and the abdomen paler green, otherwise like the male.

Near the anterior margin of each segment of the abdomen in some specimens there is a faint indication of a darker fascia. Male and female specimens; Ithaca N. Y. Brookings, S. D.

9. Tanytarsus fatigans n. sp.

(Pl.30, fig.18)

Female. Head greenish; palpi, and antennae except basal joint, infuscated; proboscis yellow. Thorax greenish, with three dark subshining, brown or blackish stripes; scutellum and pleura pale greenish or yellow; metanotum and sternum blackish. Abdomen grass-green. Legs pale yellowish, slightly infuscated; hairs not long; fore metatarsus over one third longer than the tibia. Wings hyaline, sparsely haired, veins yellowish, venation as figured. Halteres greenish. Length, 2 to 3 mm.

Var. a. One female specimen has darker face, proboscis, and fuscous legs, otherwise agrees with the above description. Taken at same time and place. Ithaca N. Y., April.

10. Tanytarsus dissimilis n. sp.

(Pl.25, figs. 16 to 21)

Larva. Small, white, with brownish tint; found among the trash in the bottom of a muddy pond. Length 3 to 4 mm. Head pale brown, short, with a few dorsal setae. Eye spots, a pair on each side, distinctly separated, antennae nearly double the length of the mandible (fig.17). Labrum with a number of prominent curved setae, some of them pectinate (fig.16 l); epipharynx normal (fig.16). Mandible with a subapical and a lateral seta and a row of fine hairs overhanging the tip. Maxilla with a short palpus, some small papillae and several slender, pointed, mesad projecting lobes (fig.16 mx). The anterior feet are provided with numerous pale curved setae. Thorax with a few pale and very inconspicuous setae. Claws of the posterior prolegs few in number and bilobed. Caudal blood gills four in number and rather prominent. Caudal setae brown; a single shorter and more delicate seta is placed upon each pedicel upon its anterior side.

Pupa. Pale yellowish; length about 3 mm. Thorax with long, slender pointed respiratory organs with hairs upon them. Upon the thorax caudad of the middle are a few rather conspicuous setae. The second, third, fourth and fifth abdominal segments are marked as shown on pl.25, fig.20. The second has two gray triangular pigment spots, their bases near the posterior margin; a few small setae, and the usual transverse posterior row of longitudinal ridges; the third has a broken transverse posterior row of long and prominent black setae, besides a few scattered ones; the fourth has an anterior row which joins the cephalic ends of the two longitudinal rows of long black setae and an anterior median patch of short, stout, black spines, besides several scattered setae; the fifth has two contiguous or nearly contiguous patches near the anterior margin of short stout black spines, and

a pair of discal setae. The lateral fin of the eighth segment terminates in a comb with six or seven short black teeth. The caudal fin is elongate and has the usual fringe of matted hairs.

Imago. Differs from T. exiguus n. sp. in being darker, in having a shorter metatarsus, and in the form of the male genitalia. It is yellowish green, sometimes nearly wholly yellow, more or less infuscated, with three brown thoracic stripes.

Male. Head yellow, including proboscis, palpi and the large basal joints of the antennae; the antennae brown, the basal portion of each hair appearing paler; eyes black. Thorax yellow, slightly infuscated, with a greenish tinge, usually with three more or less distinct buff or pale brown, sometimes darker, stripes. Abdomen green, slender, yellow toward tip; genitalia elongate (pl.33, fig.3), with a dorsal downward curved keel (d), and four pairs of appendages; an elongated pair of lateral lobes (l), a pair of inferior lobes (i) with rounded ends, a pair of short, blunt, superior lobes (s) with much incurved ends, and finally a pair of brush-like appendages (a) projecting mesad from the side of the superior lobes. Legs hairy, uniformly light yellow, sometimes slightly infuscated, tips of middle and hind tibiae each with a pair of minute black combs with an elongate middle tooth, forming a spur. Fore metatarsus about one half longer than its tibia. Wings pale, hairy, the heavier veins close to the anterior margin, all veins pale yellow. Halteres white. Length 1.75 to 2.25 mm.

Female. Like the female of T. exiguus n. sp. but is considerably darker yellow; the thoracic stripes are brown, metathorax brown, abdomen deeper green, the legs pale grayish yellow, sometimes fuscous. In dried specimens all colors appear rather dusky. Length 1.25 to 1.75 mm. Proportion of metatarsus to its tibia like that of the male.

This species was bred a number of times during May, July, and October from pond water. Ithaca N. Y., Ottawa, Canada (from Professor Fletcher).

Var. a. Larva can not be distinguished from the foregoing; the pupa differs in having fewer setae upon the dorsum of abdomen. (See fig.18 for the arrangement of these setae.) This variety has been bred several times. There seems to be no intermediate stage. The adults of this variety seem to be a little more dusky than those of the other.

11. Tanytarsus fulvescens n. sp.

(Pl.30, fig.19)

Male. Testaceous; segments of the abdomen brown with paler posterior margins. Length 3 mm. Head with palpi, probocis, and antennae, and its hairs brownish. Dorsum of the thorax, pleura and scutellum testaceous, with cinereous reflections; the

three dorsal stripes, the sternum and the metanotum brown, the long hairs in the longitudinal rows and those on the scutellum brown. Abdomen brown, with blackish hairs, posterior margins of the segments cinereous white; the genitalia brown, the lateral lobes long and stout. Legs yellowish or testaceous, the tarsi a little darkened, fore legs with short, the middle and hind legs with long hairs. Fore metatarsus about one fourth longer than its tibia. Wings hyaline, appearing somewhat dusky on account of the dark hairs which cover them; veins yellow, margin deeply fringed, venation as figured. Halteres yellow, the knob sometimes slightly infuscated.

Female. Face, basal joints of the antennae and the hairs of the thorax more yellowish; otherwise like the male. Ithaca N. Y. July.

12. Tanytarsus muticus n. sp.

(Pl.30, fig.20)

Male. Yellowish, with three reddish brown thoracic stripes. Head yellowish or greenish, palpi and proboscis yellow; antennae including the hairs and the basal joint brownish. Dorsum of the thorax greenish yellow, with three broad reddish brown stripes, metathorax and sternum brown; scutellum and pleura yellowish. Abdomen greenish, yellow, somewhat infuscated. Hairs pale; genitalia yellow in color and elongate. Legs yellow, somewhat darkened, except the trochanters and bases of femora; the middle and hind pairs longer haired than the fore pair; fore metatarsus one third or one fourth longer than its tibia. Wings hyaline, hairy, veins pale yellow; venation as figured. Halteres yellow. Length 2.5 to 3 mm. Ithaca N. Y.

13. Tanytarsus exiguus n. sp.

Larval case. Numerous fibrous, slender, conical cases are found attached to the rocks in the bottom of shallow brooks in places where the water flows most swiftly during the summer months. Hundreds of these cases may be sometimes found upon a single piece of rock no larger than a man's hand. The cases are slender, conical, with a basal stem and three, or occasionally four, apical filaments; the body is about 3.5 to 4 mm. in length. The color is a pale brown like that of dried grass; the structure is fibrous like that of a Simulium case. The case is reinforced longitudinally by three ribs, the basal prolongations of the filaments; the stem is slightly enlarged at the base, by which it is attached to the rocks. During the early summer most of the cases will be found attached by the stem alone, but later in the season most of them lie flat on the rock and are attached along one side like Simulium pupal cases. Within this case is a small greenish yellow larva, or later,

the tiny pupa. The case is shown on pl.26, fig.9. Ulmer (p.401, 1903) notes a similar structure for an European species.

Larva. (Pl.26, figs.8 to 15). The larva is pale greenish yellow, with a brownish yellow head and elongate antennae; the length is from 3 to 4 mm. Head about 1.5 times as long as wide, with a number of short setae, two at the base of each antenna, two on the front, one mesad, one laterad and one in front of each pair of eyes. There are two eye spots on each side (figs.8 and 14). The antennae (fig.13) are over one half as long as the head, each mounted upon a lateral prominence. The first joint is three times as long as the second, and has a seta on its side a little distad of the middle, and an apical seta 1.5 times as long as the second joint, the latter having two apical setae with rounded ends. The third joint is shorter than the second, the fourth is shorter than the third, the latter has a delicate apical seta. All setae are very pale yellow in color. The labrum is prominent and has two pairs of stout apical setae, one pair of which is curved and elongated (fig.14); besides this there are five or six pairs of smaller lateral setae. The epipharynx is like that of the genus Chironomus, with the usual comb, curved setae, and bifid lateral arms. The mandibles (md) have black tips, the maxillae (figs. 12 and 14 mx) each have a prominent palpus and an elongate mesad projecting process with several blades, very delicate and transparent; the brown labium with its black teeth has an outline as figured (fig.12 l). The prolegs have the usual curved hairs. Each segment of the thorax has a very few scattered setae arranged in two transverse rows. The abdomen is practically devoid of setae. The last segment has the usual dorsal tufts of setae, four short though conspicuous blood gills, and prolegs with their retractile bilobed claws.

Pupa. Pale yellow, with brownish thorax, length about 2.5 mm. The respiratory organs are slender, unbranched, pointed filaments, and bare; about one third the length of the thorax. The second, third, fourth, fifth and sometimes the sixth segment of the abdomen is dorsally marked with a pair of brown spots, upon which are a number of short brown setae, near the anterior margin. The second segment has in addition a transverse row of much finer microscopic spines near the posterior margin, and the usual transverse ridged row upon the posterior edge (fig.11). There are also a very few scattered minute setae. Each lateral fin of the eighth segment has four pale, slender filaments and a single brown apical spur. The caudal fin has the usual fringe of long matted hairs or filaments (fig.15).

Imago, male. Pale yellow, abdomen pale yellowish green. The head with proboscis and palpi pale yellow; antenna somewhat

infuscated, with pale hairs, basal joint yellow; palpi elongate; the eyes conspicuously black, deeply notched. Thorax wholly yellow, with three buff-colored, sometimes indistinct, dorsal stripes. Abdomen quite pale green, very slender and with pale hairs; genitalia (pl.33, figs.4 and 4a) yellow, with four pairs of appendages; an elongate pair of lateral lobes with upturned ends (l), a pair of elongate inferior lobes with rounded ends (i), a pair of short superior lobes with sharp apex and recurved setae (s), a pair of mesad projecting brushlike appendages (a), and finally a curved dorsal keel (d). Legs wholly cream white, tips of middle and hind tibiae each with two tiny black combs, one tooth of each comb being prolonged into a short spur. Legs rather hairy; fore metatarsus nearly three fourths longer than its tibia. Wings white, hyaline, spotless, hairy, margin with long fringe, veins pale. Anterior veins closely crowded towards costal margin, so that the veins are difficult to distinguish. Halteres white. Length 1.5 to 2 mm.

Female. Like the male, differing only as follows: A little shorter, antennae yellow, last joint dark on the lateral surface; abdomen shorter and broader, and often entirely yellow, though sometimes green.

This species is very common among the shrubbery near swift-flowing brooks. Ithaca N. Y.

14. Tanytarsus tenuis Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:255, 112
1850 Chironomus Zett. Dipt. Scand. 9:3581, 113
1864 Chironomus Schiner. Fauna Austr. 2:598
1874 Tanytarsus V. d. Wulp. Tijd. v. Ent. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p. 288, 11
1898 Chironomus Lundb. Videńsk. Meddel. p.284, 70

Pale greenish yellow; dorsum of the thorax with three ferruginous longitudinal stripes; sternum and metathorax also ferruginous. Abdomen of the male very slender, somewhat darkened toward the end, and with long claspers. Antennae yellowish, the hairs appearing lighter; palpi dark brown. Legs pale yellow, the tibiae with black spots at the tip; fore metatarsus twice as long as its tibia. Wings whitish, delicately haired. Halteres pale yellow. Length 2 to 3 mm. Schiner, loc. cit. Greenland. Lundbeck. Specimens from South Dakota and Washington seem to be this species.

15. Tanytarsus flavellus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.816, 41
1850 Chironomus Zett. Dipt. Scand. 9:3584, 117
1864 Chironomus Schiner. Fauna Austr. 2:598

1874 Tanytarsus V. d. Wulp. Tijd. v. Ent. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p.288, 12

(Pl.30, fig.21)

Head, antennae and palpi pale yellow; the antennal hairs of the male brownish yellow; tip of the palpus brownish; eyes black. Thorax, scutellum and metathorax pale yellow, the thoracic stripes pale ferruginous; abdomen pale green; the claspers pale yellow. Legs and halteres pale yellow; fore metatarsus about 2.5 times as long as its tibia. Wings with yellowish tint, pale veins and densely haired. Length 1.25 to 1.5 mm. Translation from V. d. Wulp. Several specimens; Ithaca N. Y.

Tanytarsus (?) sp.

This is a very peculiar little larva from Saranac Inn N. Y. which I doubtfully refer to Tanytarsus, though it may belong to some one of the other genera, Chasmatonotus, Eurycnemus, etc., the larvae of which have not yet been described as far as I am aware.

Larva pale yellowish, length about 2.5 mm. It was found in a little case constructed of grains of sand like those of some caddis-flies. A dorsal view of the head is shown on pl.20, fig.10. The head is about 1½ times as long as wide, dark brown in color. There are a number of setae upon the dorsal surface, distributed as in the figure; on the posterior part are about 12 blunt tubercles; at the base of each antenna (a) is a peculiar process with sharp, finger-like projections (b). The antennae are wanting in the single specimen, but judging from the size of the basal articulations they are probably considerably elongated. The labrum possesses prominent setae; the epipharynx is provided with the usual transverse comb, prominent and elongate lateral arms, and curved setae. The mandible is stout and has a prominent lateral subapical seta. The maxilla has a prominent palpus, and the labium has a toothed margin much resembling the one shown on pl.22, fig.7, but with the central tooth somewhat wider and with but 13 instead of 15 teeth. The anterior prolegs have a number of slender, curved, pale setae, not pectinate. Upon the dorsal surface of the thoracic segments are a few long, slender, pale setae. The posterior end of the abdomen is wanting in this specimen.

Genus 43. Eurycnemus Van der Wulp

Tijdschr. v. Entom. XVI (LXX) and XVII, 135

Imago. Head flat in front, covered by the conically produced thorax; front broad, arched; eyes small, reniform; ocelli wanting.

Antennae of the male as long as the head and thorax taken together, 14-jointed, the first joint short, disk-like, the following joints densely plumose; the antennae of the female shorter, 7-jointed, with a few erect hairs. Proboscis short, palpi curved, 4-jointed, the joints of about equal length. Thorax and abdomen hairy, the thorax strongly developed, highly arched, conically produced in front; scutellum and metanotum arched; the sternum projecting almost nipple-like from between the fore and middle legs (pl.34, fig.24). Abdomen cylindrical, the genitalia moderately enlarged; legs thickly haired, the apical ends of the femora and all of the tibiae, particularly the hind ones, thickened; the fore metatarsus about one fourth shorter than the fore tibia, upon each side with long cilia. Wings long and narrow, thickly haired; the anal angle prominent; R_1 and R_{4+5} straight, the latter ending at the end of the costa; crossvein proximad of the mid length of the wing; media unbranched, almost straight and entering the margin immediately below the apex of the wing; the fork of the cubitus distad of the crossvein; both branches bent gently downward; humeral crossveins quite distinct. V. d. Wulp, loc. cit.

KEY TO THE SPECIES OF EURYCNEMUS

Larvae and pupae of the species of this genus have never been described as far as I am aware. Walker's two species may not belong to this genus, but are placed in the following key because of that author's statement "allied to aestivus."

Imagines

a Thoracic stripes and fasciae on abdominal segments brown; length 4 mm. (N. J.) ..... 1. scitulus

aa Thoracic stripes yellow

b Thorax yellow; length 5.5 mm. ..... 2. unicolor

bb Thorax green with orange colored stripes; length 9 mm. 3. lasiomerus

1. Eurycnemus scitulus Coquillett

1901 Eurycnemus Coq. Proc. U. S. Nat. Mus. 23:608

Female. Yellow, the palpi, apices of antennae, four vittae on the mesonotum, a small spot below and slightly in front of each wing, the metanotum, except the upper margin and sides, a broad fascia at base of abdominal segments two to seven; the knees, apices of tibiae and of tarsal joints, dark brown; mesonotum subopaque, front tarsi bare; wings almost wholly covered with brown hairs grayish hyaline, the portion in front of the first (R_1) and third (R_{4+5}) veins pale brown; veins brown; length 4 mm. Habitat: Riverton, New Jersey.

2. Eurycnemus (?) unicolor Walker

1848 Chironomus Walk. List Dipt. Brit. Mus. 1:19
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Female. Body hairy, saffron or pale orange color; feelers yellow; eyes black; legs pale yellow, very hairy; wings colorless, hairy, fringed; veins yellow; poisers pale yellow. Length of body 5.5 mm.; of wings, 9 mm. Nova Scotia. Allied to aestivus.

3. Eurycnemus (?) lasiomerus Walker

1848 Chironomus Walk. List Dipt. Brit. Mus. 1:19
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Male. Wings hairy. Head orange; feelers very downy; their hairs yellow; chest green; the usual three stripes orange colored; abdomen yellow, thickly fringed with hairs along each side; legs yellow, hairy, especially the feet and the tips of the shanks of the fore legs; wings white; veins pale yellow; poisers yellowish white. Length of body 9 mm.; of wings 12 mm. St Martin's falls, Albany river, Hudson's bay.

This species has the chest produced in front like C. aestivus Curtis (=C. hirtipes Macq.) to which it is nearly allied. Walker, loc. cit. C. aestivus, mentioned above, is a synonym of elegans Meig., the type species of the genus Eurycnemus.

Genus 44. Metriocnemus Van der Wulp

Tijd. v. Entom. XVI (LXX) and XVII, 136

Imago. Antennae of the male fourteen-jointed, long and densely plumose; antennae of the female seven-jointed, with a few suberect hairs; in both sexes the first joint is thick, disk-like. Proboscis short, palpi bent, four-jointed. Eyes emarginate, ocelli wanting. Thorax highly arched, more or less produced over the head, sternum strongly arched. Abdomen as in Chironomus; in the male the anal is distinctly separated from the preceding segments, and is provided with a pair of filiform or sometimes widened claspers (pl.33, figs. 6, 8). Legs slender, the hind legs hairy, fore metatarsus shorter than its tibia. Wings hairy, particularly toward the tip; anal angle prominent; the vein R_{4+5} straight and running parallel with the distal end of R_1 and ending a short distance before the tip of the costa; the crossvein is at or even a little proximad of the mid length of the wing; the media is simple; the fork of the cubitus is directly under or even a little

distad of the crossvein; both branches gently bent downward toward the hind margin of the wing; humeral crossvein more or less distinct. Small species usually not exceeding 4 mm in length. V. d. Wulp, loc cit. For a characterization of larva and pupa, see M. knabi.

KEY TO SPECIES OF METRIOCNEMUS

Imagines

a Yellowish species

b Abdomen brown with the incisures more or less yellow

c Fore metatarsus about two thirds as long as its tibia; length 1 to 1.33 mm. ..... 1. nanus

cc Fore metatarsus about 0.8 as long as its tibia; length 3 mm. 2. flavifrons n. sp.

bb Abdomen chiefly yellow

c Large species 6 or 7 mm. in length; thorax yellow with three brownish stripes, and yellow abdomen with brown spots 3. par. n. sp.

cc Smaller species with abdomen nearly uniformly yellow

d Species having wings only sparsely haired; the posterior branch of the cubitus suddenly deflected; abdomen yellow; length 2 to 3 mm. (Greenland). (See Camptocladius gramini-cola)

dd Not as above

e R_{3+5} short, ending far before the tip of the wing; halteres white; length 1.25 to 1.75 mm. (Greenland) 4. debilipennis

ee R_{3+5} extends nearly to the tip of the wing; halteres yellow 5. lundbeckii nom. nov.

aa Grayish, brown, or blackish species

b Thorax with three blackish stripes; ground color yellow; scutellum and metanotum black; legs sordidly yellow or pale fuscous; fore metatarsus about two thirds as long as its tibia; abdomen fuscous; male; length 2 mm. ..... 6. exagitans n. sp.

bb Not as above

c Legs yellow

d Thorax gray with black stripes; abdomen usually with whitish incisures; fore metatarsus nearly as long as its tibia; length 3 mm. ..... 7. incomptus

dd Thorax with yellow ground color and blackish stripes; abdomen with posterior margins of segments yellow; fore metatarsus 0.8 as long as its tibia ..... 2. flavifrons n. sp.

cc Legs black or brown

d Smaller species; length 1.5 to 2 mm.

e Halteres black; dull black, resembling Orth. stercorarius ..... 8. atratulus

ee Halteres white; black; metanotum somewhat polished 11. knabi

dd Larger species; if 2 to 2.5 mm., then velvet black, and otherwise not as above

c Legs long and densely haired; fore metatarsus two thirds as long as its tibia; length 3 to 4 mm. (Greenland)

9. ursinus

cc Legs sparsely haired; male velvet black, female dull; fore metatarsus but little over half as long as its tibia

10. fuscipes

NOTE.—Consult also auxiliary key containing Walker's species, p.198.

1. Metriocnemus nanus Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:50, 69
1874 Metriocnemus V. d. Wulp. Tijd. v. Ent. 17:136
1877 Metriocnemus V. d. Wulp. Dipt. Neerl. p.292, 4

Antennae and palpi dark brown; head and thorax yellowish green, the stripes grayish black, the sternum black. Abdomen brown above with pale incisures, the venter pale yellow. Legs brown. Wings hyaline, the veins somewhat brown. Halteres white. Length, male, 1.33 mm.; female, 1 mm. Meigen, loc. cit.

This species is said to occur in Greenland (Lundbeck). The identification being doubtful, Lundbeck redescribed the Greenland specimens. For these I propose the name lundbeckii (see no. 5.)

2. Metriocnemus flavifrons n. sp.

(Pl.31, fig.1)

Male. Head yellow, proboscis and palpi fuscous, the first joint of the antenna shining brown, the second yellow, the remaining joints and the hairs fuscous. Eyes black. Dorsum of the thorax yellow with three dull, dark brown stripes, sparsely covered with pale hairs. Pleura yellow, scutellum, metanotum, and sternum dark brown. Abdomen dark brown with the posterior one third of each segment yellow; hairs and the genitalia pale brown. Coxae brown, legs yellowish, the tarsi slightly infuscated, legs very sparsely haired, anterior metatarsus about four fifths as long as its tibia. Wings hyaline, hairy, R_{4+5} straight and ends close to the tip of the wing; halteres pale. Length 3 mm.

Female. Like the male, but has wider wings; venation as figured. Ithaca N. Y., July.

3. Metriocnemus par n. sp.

(Pl.31, fig.2; pl.33, fig.6)

Male. Yellow, the antennae except the basal joint, apices of front femora, of their tibiae and of the first two tarsal joints, the whole of the remaining joints, also the last two on the other

tarsi, brown; a pair of rather large black or dark brown spots on abdominal segments two to seven, last segment and the genitalia (pl.33, fig.6) also brown; mesonotum marked with three darker yellow or brownish vittae, the middle one divided, hairs of the antennae brownish; front tarsi destitute of long hairs, middle and hind legs rather hairy, the fore metatarsus about three fourths as long as its tibia, the fourth joint of the tarsi more than one fourth as long as the first; wings hairy, whitish hyaline, the veins yellowish; venation as figured; length 6.5 mm. In one specimen, the one with the darker thoracic vittae, the tips of the middle and hind femora and tibiae are darkened. Axton, N. Y. A female specimen from New Jersey has dark brown thoracic stripes and larger spots on abdomen.

In the paper by Messrs MacGillivray and Houghton in the Entomological News, January, 1903, this fly was identified as Orthocladius par Coq., with the description of which it agrees pretty well except for its hairy wings; the latter fact I had overlooked.

4. Metriocnemus debilipennis Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.286, 76
1902 Metriocnemus Kertesz. Cat'l. Dipt. 1:229

Male. Thorax yellow, with three brown stripes, the median one posteriorly, the lateral ones anteriorly abbreviated, the pleura yellow, the sternum brownish gray, the scutellum yellow, the metathorax brown. Abdomen yellow, with yellow pile. Antennae brown; the palpi sordidly yellow. Legs yellow, the halteres white. The wings whitish hyaline, hairy, the anal lobe but little produced, obtuse-angled, R_1 and R_{4+5} run close together, the latter much shortened, and runs into the costa far before the tip of Cu_1; the media runs into the tip, the base of the fork of the cubitus is a little distad of the base of R_{4+5}, the lower branch is a little curved at the tip. The middle and hind legs are distinctly pilose, the anterior metatarsus is a little shorter than the tibia.

Female. A little shorter than the male, also a little paler, the wings wider and more hairy, the anal lobe more widely rounded; in other respects like the male. Length, male and female, 1,25 to 1.75 mm. Greenland. Lundbeck, loc. cit.

5. Metriocnemus lundbeckii nom. nov.

1898 Chironomus nanus Lundb. (nec Meig.). Viden. Med. p.285

Male. Thorax yellow, in dried specimens often sordidly yellow or fuscous, with three brown stripes, the middle one abbreviated

posteriorly or less distinct, the lateral ones anteriorly abbreviated; the pleura yellow, the sternum brown, the scutellum yellow, the metathorax more or less dilutely brown. Abdomen yellow with yellow pile. Antennae dilutely brown or yellow; the palpi yellow. Legs and halteres yellow. Wings whitish hyaline, moderately hairy, the anal lobe not produced, widely rounded, the veins thin and pale, toward the costa a little stronger, R_{4+5} straight, its apex nearly over the tip of Cu_1; the costa is produced a little beyond the tip of the radius, the media runs into the tip, the posterior branch of the cubitus is suddenly deflected. The middle and hind legs are hairy; the fore metatarsus is a little shorter than its tibia.

Female. Shorter than the male, its thorax a little paler, the wings a little more hairy; in other respects like the male. Length 1.5 to 2 mm. Southern Greenland. Lundbeck, loc. cit.

Var. a. (Pl.31, fig.3.) Some Ithaca specimens agree very well with the above description, but the palpi are pale fuscous instead of yellow, and the sternum is dusky yellow instead of brown. The fore tarsi are slightly infuscated and the posterior branch of the cubitus is suddenly deflected near the end similar to but in less degree than in Camptocladius; in the latter respect it differs particularly from my specimens of M. nanus Meigen. The fore metatarsus is about three fourths as long as its tibia.

Var. b. A specimen from Chicago is wholly yellow; the mouth parts, antennae, three thoracic stripes, a spot on the pleura, the metanotum and sternum, brown. The legs, excepting the coxae and trochanters, somewhat infuscated. Wings hyaline, hairy, anterior veins slightly yellow. Halteres yellow. Length 2.5 mm.

6. Metriocnemus exagitans n. sp.

(Pl.31, fig.4)

Male. Head yellowish, palpi and antennae fuscous, proboscis yellowish; dorsum of thorax with three subshining blackish stripes, the middle one divided; the plura, humeri, and space between the dorsal stripes, yellow; a spot on the pleura, the sternum, scutellum and metanotum subshining black. Hairs on dorsum black. Abdomen wholly fuscous or subfuscous, the hairs and the genitalia somewhat paler. Coxae fuscous, the trochanters and bases of femora yellow; remaining parts of the legs sordidly yellow or pale fuscous; the fore metatarsus about two thirds as long as its tibia. Wings hairy, hyaline, very slightly smoky; R_{4+5} extends nearly to the tip of the wing; costa extends a little beyond the tip of R_{4+5}; venation as figured. Halteres yellowish. Length 2 mm. Two specimens, Ithaca, N. Y.

7. Metriocnemus incomptus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.816, 42
1850 Chironomus Zett. Dipt. Scand. 9:3586, 121
1864 Chironomus Schiner. Fauna Austr. 2:607
1898 Chironomus Lundb. Vidensk. Meddel. p.285, 73

Gray; dorsum of the thorax with three black longitudinal stripes, which are often indistinct; the metanotum blackish; the abdomen with pale incisures, at the base sometimes lighter. Head dark; the palpi pale yellow, the antennae testaceous. Legs pale yellow, the coxae and all the articulations brown or at least darker; fore metatarsus but little shorter than its tibia. Wings whitish, spotless, thickly haired; the halteres pale. Length 3 mm. Schiner, loc. cit. (Greenland, Lundbeck.)

The fly described by Van der Wulp as M. incomptus is a synonym of M. modestus Meigen according to Kertesz (1902).

8. Metriocnemus atratulus Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3590, 128
1864 Chironomus Schiner. Fauna Austr. 2:608, 56
1884 Metriocnemus Mik. Wien. Ent. Zeitg. 3:202
1898 Chironomus Lundb. Vidensk. Meddel. p.285, 74

(Pl.31, fig.5, pl.33, fig.8.)

Resembles Orthocladius stercorarius Deg., but differs in having hairy wings. Dull black; abdomen black-haired; the anal segment wider. Antennae and its hairs black. The legs black, the tarsi brown; the fore metatarsus but little more than one half as long as its tibia. Halteres black; wings white, with a darker stripe at its base; delicately haired. Length 1.5 to 2 mm. Schiner, loc. cit. (Greenland, Lundbeck.)

Several specimens from Ithaca, N. Y., agreeing with the above description have the thoracic hairs, especially of the male, pale brown.

9. Metriocnemus ursinus Holmgren

1869 Chironomus Holmgr. K. Svensk. Vet. Akad. Handl. 8:5, 39
1898 Chironomus Lundb. Vidensk. Meddel. p.284, 71
1902 Metriocnemus Kertesz. Cat'l. Dipt. 1:232
1865 Chironomus arcticus Bohem. Öfv. K. Vet. Akad. Förh p.574, 19
1845 Chironomus aterrimus Staeger (nec Meig.). Kröjer. Naturh. Tids. 1:353, 8
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Head black; antennae fuscous black, densely plumose, basal joints of the flagellum stouter. Thorax black, subopaque,

in some lights shining cinereous; black bristled, especially on the sides in front of the wings; scutellum obtuse, black bristled. Abdomen black and black-haired, the anal segment obtuse, flattened (after death), the appendages bearded. The wings cinereous whitish, toward the costa somewhat infuscate, the tip hairy, especially in the radial cell, the remaining surface nearly bare; the posterior margin ciliate. Halteres fuscous black. The legs fuscous black and long-haired except the fore tibiae and tarsi, which are short pilose; fore metatarsus one third shorter than its tibia.

Female. The thorax and abdomen with pale setae, the wings somewhat hairy; the halteres fuscous black or sometimes pale fuscous. Length 3 to 4 mm. Holmgren, loc. cit. (Greenland, Lundbeck.)

Lundbeck (1898 p.284) in a note states, "The wings are very sparsely haired and only toward the apex, the wing of the female being a little more hairy between the branches of the radius than that of the male. The hairs seem to rub off readily, and hence many specimens are found with only a trace."

10. Metriocnemus fuscipes Meigen

1818 Chironomus Meig. Syst. Beschr. 1:49, 65
1850 Chironomus Zett. Dipt. Scand. 9:3578, 107
1864 Chironomus Schiner. Fauna Austr. 2:607
1874 Metriocnemus V. d. Wulp. Tijds. v. Ent. 17:136
1877 Metriocnemus V. d. Wulp. Dipt. Neerl. p.291, 2
1898 Chironomus Lundb. Vidensk. Meddel. p.284, 72
1865 Chironomus carbo Phil. Verh. z. b. Ges. Wien. 15:600, 11
1818 Chironomus picipes Meig. Syst. Beschr. 1:25, 74
1850 Chironomus Zett. Dipt. Scand. 9:3589, 125
1864 Chironomus Schiner. Fauna Austr. 2:612
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Black, not shining; the anal segment of the male wider than the preceding one. Forceps small, its arms rather robust. Palpi and antennae black, the hairs of the latter sometimes tinged with brown. Legs black, or pitchy; fore metatarsus about one half as long as its tibia. Wings pale brownish or whitish according to the incidence of the light; the hairs dark, more perceptible at the tip; fork of the cubitus distad of the small crossvein. Halteres of the male black, of the female pale. Length 3 to 4.5 mm. Schiner and V. d. Wulp, loc. cit. (Greenland, Lundbeck.)

The species described by Zetterstedt appears to be different, judging from the different relative lengths of fore tibia and metatarsus.

The following is Meigen's description of M. p i c i p e s:

Wholly velvet black, including antennae and halteres; only the legs are pitchy, and the wings are grayish, hairy. Length 2 to 2.5 mm. (Greenland, Staeger.)

11. Metriocnemus knabi Coquillett

1904 M e t r i o c n e m u s Coq. Canadian Entomologist. p.11

Larva. Pale yellow; head dark yellow; eyes, apical half of the mandibles, margin of the labium, dark brown. Claws of both fore and hind prolegs yellow; the dorso-caudal papillae yellow, with about six black setae. Head short, about 1.5 times as long as wide; antennae short like Chironomus; eye spots small, each composed of two confluent pigment spots, the anterior one

Fig. 16 Ventral aspect of larval mouth parts of Metriocnemus knabi x180

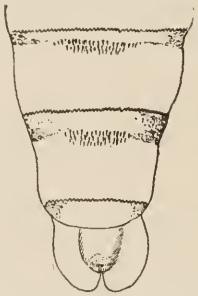


Fig. 17 Dorsal aspect of caudal end of pupa of Metriocnemus knabi x180

smaller. Mouth parts resembling those of Orthocladius, the mesad projecting processes of the maxillae spine-like, the palpi small; the labrum, epipharynx, lateral arms and hypopharynx as in the above-mentioned genus. Labium with the first and second pairs of lateral teeth smaller than the third, fourth and fifth pairs. Anterior prolegs with simple setae (i. e. not pectinate), at the base punctate with groups of minute and very short spines. The claws of the posterior prolegs of two sizes, the laterals slender, the peripherals shorter, stouter and broadened at base. There are four anal blood gills on the 12th segment but the ventrals of the 11th segment appear to be wanting. The dorso-caudal papillae are more than three times their diameter in length, in this respect resembling Tanypus. At the apex of each papilla there are about six long black setae.

Pupa. It resembles an Orthocladius pupa, but the breathing trumpets are apparently wanting. The dorsal posterior margin of each abdominal segment minutely scalloped. Near the anterior

margin of each segment there is a transverse patch of short, fine setae with stout bases. The last segment terminates in a bilobed paddle. The genital sack of the male pupa is longer than that of the female. The specimens of larvae and pupae upon which these descriptions are based were obtained from Mr. Fred Knab.

Imago, male and female. Black, knobs of the halteres whitish, hairs of antennae brown, those of the body yellowish; mesonotum somewhat polished, front tibiae twice as long as the first joint of their tarsi, hind tibiae outwardly fringed with rather long hairs, all tarsi with a short pubescence, but without hairs, the fourth joint slender and longer than the fifth; wings grayish hyaline, densely covered with brown hairs, third vein (R_{4+5}) almost straight; length 1.25 to 2 mm. Westfield, Massachusetts. Description of the imago from Coquillett; loc. cit.

The male genitalia of the type shown on pl.33, figs. 1, 2 and 8.

Genus 45. Scopelodromus Chevrel

Arch. de Zool. Exp. et Gen. 4 ser. 1:1. 1903.

This genus as defined by its author appears to be closely related to or identical with Thalassomyia. Antennae in both sexes seven jointed; the first joint disklike, the second slightly elongate, the third to sixth short and closely sessile, the seventh ovate and slightly enlarged, its apex with a minute button. The palpi are at least as long as the antennae, four jointed; the first joint appearing double, mushroom shaped, its stem obconate, short pubescent, its head flattened, discoidal, pilose and provided with setae; *the second joint is spherical* and with a short pedicel; the third and fourth joints are elongate as in Thalassomyia. The tarsal claws of all the feet of the female, both claws of each hind foot, and the outer claws of the other feet of the male, simple; the inner claw of each fore and middle foot of the male is stouter, flattened, spoon shaped, and from the figure it appears as if the apical margin were scalloped; the empodium pectinate. The apex of the abdomen of the female is provided with a pair of jointed appendages; the basal joint of each is slender, the second short, obconate, the third disklike, thin, its plane vertical, oval in outline, its apical margin notched; male genitalia resembles that of Thalassomyia fusca. The form of the head, eyes, thorax, abdo-

men, legs, etc. like Thalassomyia. The fore metatarsus is shorter than its tibia, the fourth tarsal joint on all feet of both sexes obcordate, shorter than the fifth; apex of each tibia with two delicate setae; wing venation as in Thalassomyia, the surface under a low power, appears punctate, under high power, short haired.

The larvae were found upon the rocks among the algae at the seacoast, in the Bay of Saint Malo, Brittany. They are described as green in color, ten or twelve mm. in length. The labium has 14 teeth, the two median, larger than those adjacent; in other respects it does not appear to differ from Thalassomyia fusca. The eggs are oval, measuring 200 to 280 microns, and are deposited singly or in little groups, embedded in a jellylike substance.

The type species and the only one described, is S. isemerimus Chevrel. From Chevrel's description it will be seen that the female differs from Thalassomyia fusca and congregata in the form of the first and second palpal joint and in color characters. Whether it differs in any particular from T. frauenfeldi I am unable to say since Schiner's description does not mention the form of the palpal joints. The male differs from the male of T. fusca in the number of antennal joints, the form of the first two palpal joints and in the formation of the tarsal claws. The males of T. congregata and frauenfeldi have not been described as far as I am aware.

Genus 46. Macroptilum Becker

Mitteilungen d. Zool. Museum. Berlin No. 2. 2:77

Since the foregoing pages were written it was found that this genus, which was recently described by Becker, was overlooked. The type of the genus and the only described species is Macroptilum nudum Becker, from Egypt.

Errata

P. 142, line 14, for "pulcripennis" read "pulchripennis."

ADDENDA

A number of larvae representing three species were taken by Mr. R. E. Richardson from the stomach of a shovel-nose sturgeon. The fish was caught June 1904 in the Mississippi river near Grafton, Illinois. All the specimens were in rather poor condition, but they nevertheless exhibit peculiar characters which prevent placing them in any of the foregoing genera. Two of them (A and B) are certainly members of the group Chironomus, and possibly belong to the genus Tanytarsus. The third one is a Chironomid having both Chironomus and Ceratopogon affinities.

Chironomus sp. A.

Length 7 mm. Body stout, greenish in color; head brown, small, only about half as wide as the thoracic segment, tapering; eyes each consisting of two small distinctly separated pigment spots,

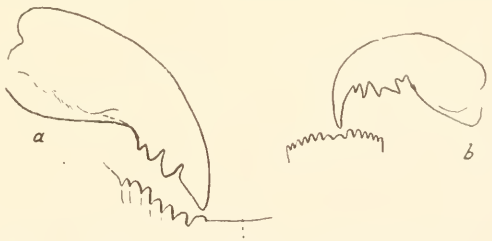


Fig. 18 Mandible and labium; larva A x400; larva B x180

situated as far cephalad as the margin of the labium. Anterior prolegs with rather numerous curved setae; posterior prolegs slender with a few bilobed pale brown claws. Antennae long, more than half the length of the head, three-jointed, besides the short basal prominence and two slender apical processes; first joint long, second very short, no longer than wide, third about $\frac{2}{3}$ as long as the first. Mandible stout, darkened apically, with moderately stout teeth; labium with margin concave (see figure). Teeth arranged on each side of the center line, the middle section toothless. There are four anal blood gills but there are none on the ventral surface of the eleventh segment; above the superior pair of anal-gills are two stout setae; the dorso-caudal papillae are short, each with a tuft of long pale brown setae.

Chironomus sp. B.

Length 6.5 mm.; color greenish; head brown, rectangular, nearly as wide as the first thoracic segment; eyes as in species "A" described above; antennae long, about half as long as the head, three-jointed, not counting the basal prominence and the apical processes; the first and third joints about of equal length, the middle one about $\frac{2}{3}$ as long as the first. Mandible stout, black tipped, the teeth very prominent; labium rounded, teeth small, the first laterals shorter than the second (fig.18B). Fore prolegs with rather short spines; posterior prolegs not visible and probably destroyed. Caudal papillae and anal blood gills present, but not in sufficiently good condition to describe; ventral blood gills wanting.

Chironomid sp. C.

Length 9 mm. Body stout, green in color; head very small, slender and tapering, yellowish; mouth parts resembling those of Ceratopogon; mandibles small, slender, sharp, and apparently move in a nearly vertical plane. On the convex surface of the mandible is a slender spine. The antennae are long and slender, nearly as long as the head, the articulations indistinct, apex with slender processes. Eyes each consisting of a pair of pigment spots situated on the posterior fourth of the head. Margin of the labium apparently straight, toothless, not blackened, bounded on each side by the fan-shaped membrane which is present in Chironomus, the striations particularly distinct. Anterior prolegs prominent, with comparatively few, long, slender, curved, yellow, but not pectinate claws. These claws are not hair-like as in Chironomus, but more like the claws of the anterior prolegs of Ceratopogon sens. str. Posterior prolegs long and very slender, claws few in number and very small, very much smaller and shorter than those of the fore legs. Dorso-caudal papillae with its setae and the anal blood gills present. The poor condition of the specimens renders further description impossible.

Bibliography

Articles marked with an asterisk (*) relate to the biology of the species. For a more complete bibliography of the European species (Imagines) see Kertesz's Catalogus Dipterorum I, p. 156 to 249.

1903 **Adams, C. F.** Kansas Univ. Science Bulletin. 2, No. 2.
—— **Aristotles.** Peri zoon istorias. Lib. V. Cap. 19 St. 100.
1893 **Arribalzaga, F. L.** Bol. Acad. Nac. Cordoba, 13.
*1880 **Asper.** Zool. Anzeiger. 130–134; 200–207.
*—— **Balbiani.** Rec. Z. Suisse. 2:527–588.

*1881 Balbiani. Zool. Anzeiger. 637–641; 662–666.
1903 Becker. Mitteilungen Mus. Berlin. 2.
1887 Bergroth. Ent. Nachrichten. 13.
*—— Berkeley. Ann. and Mag. Nat. Hist. 7:449.
1887 Beuthin. Dipt. d. Umgegend. Hamburg. Verh. Ver. Hamb. 6:46.
1844 Bohemann. Öfv. K. Vet. Akad. Förhandl.
1865 Bohemann. Öfv. K. Vet. Akad. Förhandl.
*1834 Bouche. Naturg. I. T. 2.
*1883 Brauer, F. Denkschr. d. Math. Nat. Cl. d. K. Akad. Wiss. 47.
*1846 Bremi. Isis. 164–169.
*1894 Carpenter. Ent. Monthly Mag. 129.
—— Chagnon. Le Naturaliste Canadien. 39:129–131.
*1894 Chevrel. Arch. Zool. Exp. 584.
1903 Chevrel. Arch. Zool. Exp. 1.
*1895 Child. Zeitschr. Wiss. Zool. 63:475–528.
*1895 Child. Zool. Centr. Blatt. 2:162.
*1895 Child. Journ. Roy. Microsc. Soc. 46.
1894 Cockerell. Proc. Acad. Nat. Sc. Phil. 419.
*1895 Comstock. Manual for the study of Insects.
*1897 Comstock. Insect Life.
1898 Comstock & Needham. Amer. Nat. "The Wings of Insects."
1899 Comstock & Needham. Amer. Nat. "The Wings of Insects."
1895 Coquillett. Proc. Acad. Nat. Sc. Phil. 308.
1899 Coquillett. Entomological News. 60–61.
1899 Coquillett. The Fur seals and Fur-seal Islands. 4:341.
1900 Coquillett. Proc. U. S. Nat. Mus. 22:249–270.
1900 Coquillett. Proc. Wash. Acad. Sc. 2:389–464.
1901 Coquillett. Entomological News. 17.
1901 Coquillett. Proc. U. S. Nat. Mus. 23:593–618.
1902 Coquillett. Proc. U. S. Nat. Mus. 25:83–126.
1904 Coquillett. Canadian Entomologist. p.11.
*1878 Cox. The Entomologist. 261–263.
*—— Cox. Science Gossip. 14:269–270.
1829 Curtis. British Entomology.
1831 Curtis. In Ross' Voyage to the Arctic regions. 77.
*—— Dahl. Mt. Akad. Berlin. 11–24.
*1866 Darest. Arch. d. Zool. Exper. 2.
*1889 Deby. Journ. Roy. Micr. Soc. 180.
*1776 Degeer. Mem. pour servir a l'hist. d. Ins. 6.
1713 Derham. Physico Theology. Book VIII. Chap.VI. 393.
*1833 Dufour. Ann. d. l. Soc. Ent. Fr.
*1845 Dufour. Ann. d. l. Soc. Ent. Fr. 285.
*1902 Dyar. Proc. Ent. Soc. Wash. VI, No. 1. 56.
1875 Eaton. Ent. Monthly Mag. 12.
*1863 Egger. Verh. Zool. Bot. Gesell. 13:1110.
*1852 Ellenberger. Lotos. 2:89.
1780 Fabricius, O. Fauna Groenlandica.
1775 Fabricius, J. C. Syst. Entomologica.
1787 Fabricius, J. C. Mantissa Insectorum.
1794 Fabricius, J. C. Entomologica Systematica.

1805 Fabricius, J. C. Systema Antliatorum.
1848 Fitch. Amer. Jour. of Agri. and Sc. 5.
*1877 Forbes. Bul. Ill. State Labr. Nat. Hist. I, Art. 2. 71.
*1823 Fries. Monographia Tanyporum. Lund.
*1866 Frauenfeld. Verh. z. b. Gesel. Wien. 16:973.
*1830 Fries. Vetensk. Akad. Handl. 176.
*1888 Garman, H. Ill. State Lab. Nat. Hist. Bul. 3, Art. 9. 158.
*1762 Geoffroy. Histoire Abregee des Ins. etc. 2:560–566.
*1886 Gercke. Wien. Ent. Zeitg. (Ceratopogon murinus.)
*1877 Gercke. Verh. Ver. Hamburg. IV. 6.
*1880 Gercke. Verh. Ver. Hamburg. VI.
*1851 Gervais. Bul. d. l. Soc. Entom. LXX.
*—— Giard. Assn. franc. 26:299.
1847 Gimmerthal. Soc. Imp. Nat. Moscow. Bul.
1904 Girault. Psyche. 81.
*1669 Goedart. Metamorphoseos et historiae nat. Ins. 35–41.
*1780 Goeze. Der Naturforscher. Stueck. 14:113–125.
*1870 Von Grimm. Mem. Petersburg (7). XV, No. 8.
*1871 Von Grimm. Ann. Mag. Nat. Hist. (4). 31–45; 106–115.
*1833 Guerin. Ann. Ent. Soc. France. 2:161.
*1845 Guerin. Ann. Ent. Soc. France.
*1860 Hagen. Stettiner Ent. Zeitg. 222.
1855 Haliday. Nat. Hist. Review. II.
*1875 Hammond. Proc. Linn. Soc. 1875–1880. p.LIII.
*1885 Hammond. Journ. Micros. and Nat. Hist. IV. 65–74; 165–172.
*1895 Hart. Ill. State Labr. Nat. Hist. Bul., Art. 6. 149–272.
*1853 Heeger. Sitzb. d. Kais. Akad. d. Wiss. zu Wien. X, 18.
*1856 Heeger. Sitzb. d. Kais. Akad. d. Wiss. zu Wien. XX.
1869 Holmgren. Kongl. Svenska Vetensk. Akad. Handl. 8, No. 5.
1872 Holmgren. Öfv. K. Vet. Akad. Förhandl. XXIX.
1883 Holmgren. Entomol. Tijdskrift.
*1900 Howard. Proc. Acad. Sc. Wash. Insect larvae, etc.
*1901 Howard. Canad. Ent. 33:43.
1902 Imms. Entomologist. 35:157.
1900 Jacobs. Ann. d. Soc. Belgique.
*1882 Jaworowski. Zool. Anzeiger. 3:211.
*1879 Jaworowski. Sitzb. d. K. Ak. d. Wiss. Wien. 80:238, 1–20.
*1754 Joblot. Observations d. l'hist. naturelle, etc. 112–114.
*1903 Johannsen. N. Y. State Museum, Bulletin 68.
1895 Johnson. Proc. Acad. Nat. Sc. Phil.
1899 Johnson, in Smith's Cat'l. Insects of N. J.
1904 Johnson. Ent. News. 158.
*1899 Kellogg. Psyche. VIII. 303–365.
*1900 Kellogg. Biol. Bulletin 1, 82.
*1902 Kellogg. Amer. Naturalist.
1902 Kertesz. Cat'l. Dipterorum. I.
*1897 Kerville. Gadeau de, Soc. Rouen. Bulletin 366.
*1898 Kieffer. Soc. Entom. France, Bul. 108.
*1899a Kieffer. Annales Soc. Ent. France. 821, 830.
*1899b Kieffer. Bul. Soc. Ent. France.

*1900a Kieffer. Ill. Zeitschr. Entom. 4:23, 24. 5:9, 16.
*1900b Kieffer. Ill. Zeitschr. Entom. 5:22.
*1901 Kieffer. Allgemeine Zeitschr. Entom. (Aug.).
1902 Kieffer. Synopse d. Representants europ. d. groupe Ceratopogon. (Metz.)
*1882 Kienitz. Wien. Ent. Zeitg. 2, 234–235.
1824 Kirby. Suppl. to App. to Parry's First Voyage. CCXVIII.
*1843 Kölliker. Ann. sc. nat. ser. 2:253.
*1858 Kollar. Verh. Zool. bot. Gesel. Wien. 421.
*1867 Kupfer. De Embryogenesi. Diss in aug. Kiliae.
*1866 Laboulbene. Ann. Soc. Ent. France. 6, 285.
*1869 Laboulbene. Ann. Soc. Ent. France. 9:157–166.
1805 Latreille. Hist. Nat. d. Crust. et d. Ins. XIV.
1809 Latreille. Gen. Ins. et Crust. 4:248.
*1900 Leger. Ann. Soc. Ent. France (Feb.).
*1891 Levi-Morenos. Journ. Roy. Micro. Soc. 337.
*1758 Linne. Fauna Suecica. 436.
1758 Linne. Syst. Nat. Ed. X.
1767 Linne. Syst. Nat. Ed. XII.
1882 Lintner. Inj. and other Ins. of State of N. Y. 1st Rept.
1885 Lintner. Inj. and other Ins. of State of N. Y. 2d Rept.
*1843 Loew. Stett. Ent. Zeit. 28.
1861 Loew. Wien. Ent. Monatschr. V. 33–43.
1861 Loew. Berl. Ent. Zeit. Schr. V.
1865 Loew. Berl. Ent. Zeitschr. IX.
1866 Loew. Berl. Ent. Zeitschr. X.
*1902 Long. Biol. Bul. 3. 3–15.
1898 Lundbeck. Vidensk. Meddel. 269–295.
*1830 Lyonet. Mem. Posth. 17.
*1830 Lyonet. Mem. d. Mus. d'hist. Nat. XIX. 85–89.
1903a MacGillivray & Houghton. Ent. News. 10.
1903b MacGillivray. N. Y. Ent. Soc. Journ. (March).
1826 Macquart. Recueil. Soc. Sc. Agri. Lille.
1834 Macquart. Suites à Buffon. Dipteres I.
1855 Macquart. Diptères Exotiques 5e. Suppl.
1874 Mayer. Amer. Journ. Sc. 3d ser. VIII. 89–103.
1874 Mayer. Amer. Nat. VIII. 577–592.
1803 Meigen. Illiger's Magaz. II.
1804 Meigen. Klass. u. Beschr. d. Europ. Zweifll. Ins. I.
1818 Meigen. Syst. Beschr. d. Bekannten Europ. Zweifl. Ins. I.
1830 Meigen. Syst. Beschr. d. Bekannten Europ. Zweifl. Ins. VI.
1838 Meigen. Syst. Beschr. d. Bekannten Europ. Zweifl. Ins. VII.
*1886 Meinert. Vidensk. Selsk., 6. Raekke, naturvid. III. 4.
*1882 Meinert. Ent. Tidskr. 3:83–86.
*1895 Miall. Nat. Hist. of Aquatic Insects. 8vo. 395pp.
*1891 Miall. Nature, XLIV. 457–462.
*1900 Miall & Hammond. The Harlequin Fly.
1886 Mik. Wiener Ent. Zeitg. V. 187.
*1888 Mik. Wiener Ent. Zeitg. VII. 185.
*1889 Mik. Wiener Ent. Zeitg. VIII. 73, 235.

*1894 Mik. Wiener Ent. Zeitg. XIII. 23.
*1896 Mik. Wiener Ent. Zeitg. XV. 242–247.
*—— Monnier. Bulletin Soc. Vand. 2. XIII. p.60.
*1897 Morley. Ent. Monthly Mag. XXXIII. 90.
*—— Mueller, O. F. Von Würmern des süssen u. salz. Wassers. 22.
*1899 Needham. U. S. Nat. Mus. Bul. 39. Part O.
*1901 Needham. N. Y. State Museum, Bulletin 47.
*1903 Needham. N. Y. State Museum, Bulletin 68.
1873 Nowicki. Beitr. z. Kenntn. d. Dipt. Fauna Galiziens.
*1896 Osborn. Iowa Experiment Station Rept. No. 32.
*1870 Osten Sacken. Trans. Amer. Ent. Soc. III. 51.
1877 Osten Sacken. U. S. Geol. Survey. Bulletin. Art. XIII.
1878 Osten Sacken. Catalogue of Diptera, N. A.
*1869 Packard. Proc. and Commun. Essex Instit., VI. 42.
*1870 Packard. Amer. Journ. Sc. I. 100–110.
*1870 Packard. Monthly Micros. Journ. V. 133.
*1884 Packard. Amer. Nat. XVIII. 826–828.
1813 Panzer. Fauna Germanica. CIX.
*1847 Perris. Ann. Soc. Ent. Fr.
*1870 Perris. Ann. Soc. Ent. Fr. 138, 232, 320, 366.
*1900 Pettit. Mich. Ac. of Sc. First Rept. 110.
1865 Philippi. Verh. z. b. Gesel. Wien. XV, 600. 11.
1851 Poey. Mem. sobre la Hist. Nat. de la Isla de Cuba. I.
*1738 Reaumur. Mém. IV.
1884 Ridley. Ent. Monthly Mag.
*1886 Riley. Ann. Rept. U. S. Comm. Agr. (Chironomus).
1856 Rondani. Dipterologiae Italicae Prodromus. I.
1857 Rondani. Dipterologiae Italicae Prodromus. II.
1823 Say. Journ. Acad. Nat. Sc. III.
1824 Say. American Entomology. II.
1829 Say. Journ. Acad. Nat. Sc. VI.
1859 Say. Complete Writings. I, II.
1856 Schiner. Verh. z. b. Ver. VI. 216.
1862 Schiner. Fauna Austriaca. I.
1864 Schiner. Fauna Austriaca. II.
*1868 Schiner. Reise der Oestr. Fregatte Novara. Diptera.
*1848 Scholtz. Ent. Z. Breslau. 1:3, 9, 22.
1803 Schrank. Fauna Boica. III.
*1854 Schubaert. Handel. Nederl. Entom. Vereen. 10–12, 13–15.
*1849 Schubaert. Allgem. Konst. en Letterbode. 40, 41.
*1850 Schubaert. Allgem. Konst. en Letterbode. 48–50.
1886 Scudder. U. S. Geol. Survey, Bul. 31. 91.
1889 Skuse. Proc. Linn. Soc. N. S. W. (2). IV. 215–311.
*1879 Slater. The Entomologist. 87.
—— Slosson. Lists of Diptera. Ent. News.
1899 Smith. See Johnson (1899).
*1872 Smith. U. S. Comm. of Fish and Fisheries. II. 693.
1839 Staeger. Kröjer's Naturhist. Tidsskr. II.
1845 Staeger. Kröjer's Naturhist. Tidsskr. I, n. ser.
1829 Stephens. A Syst. Cat'l. of Brit. Ins.

*1867 Swainson. Trans. Micr. Soc. Lond. 99.
*1894 Swainson. Brit. Natur. 107.
*1903 Taylor. Ent. Soc. London. Trans. 521.
*1892 Theobald. An account of the Brit. flies. I. 171–204.
*1883 Tömösvary. Természetrajza Füzetek. VII. 19.
*1884 Tömösvary. Értekezések a term.-tud. köréből. XIV. 1.
1893 Townsend. Psyche. 6:370.
1894 Townsend. Journ. Institute Jamaica. I. 381.
1897 Townsend. Ann. and Mag. Nat. Hist. Ser. 6. XIX. 17. 1.
1875 Treat. Amer. Naturalist. IX. 660.
1903 Ulmer. All. Zeit. f. Ent. 8:401.
1858 Van der Wulp. Tijdschr. v. Entom. II.
1868 Van der Wulp. Tijdschr. v. Entomol. X (II).
1873 Van der Wulp. Tijdschr. v. Entomol. XVI.
1874 Van der Wulp. Tijdschr. v. Entomol. XVII.
1877 Van der Wulp. Diptera Neerlandica. I.
*1900 Vaney. Comptes rendus. L'acad. d. Sc. Paris (Nov.).
*1847 Verloren. Acad. Roy. d. Belgique. Sav. Étr. II–III.
1875 Verrall. Phil. Trans. of the Royl. Soc. London. Vol. 168.
*1861 Vinen. Linn. Soc. London. Jr. of Proc. 3.
*1838 Fisher v. Waldheim. Oryctogr. d. Moscou. X.
*1684 Wagner. Ephem. Acad. Nat. Curios. De generatione Culicum. 368.
1848 Walker. List Diptera Brit. Mus. I.
1856 Walker. Ins. Saundersiana, Diptera. I.
1856 Walker. Ins. Brit. Diptera. III.
*1893 Wassmann. Wien. Ent. Zeitg. XII. 277.
*1898 Weltner. S. B. Ges. naturf. Berlin. 63–68.
*1840 Westwood. Introduction, etc. II. 124, 510, 516.
*1873 Weyenbergh. Stettiner Ent. Zeit. 452–458.
*1874 Weyenbergh. Tijdschr. v. Ent. XVII. 149.
1883 Weyenbergh. Stettiner Ent. Zeit. XLIV.
*1886 Weyenbergh. Tijdschr. v. Entomol. XXIX. 125–133.
1828 Wiedemann. Aussereurop. Zweifl. Ins. I.
1830 Wiedemann. Aussereurop. Zweifl. Ins. II.
1896 Williston. Trans. Ent. Soc. London. 253–449.
1896 Williston. Manual of the N. A. Diptera.
1900 Williston. Biologia Centrali Americana. Diptera. 224–225.
*1873 Willemoes-Suhm. Zeitschr. f. Wiss. Zool. XXIII. 351.
1846 Winnertz. Stettiner Entomol. Zeit. VII. 12.
1852 Winnertz. Linnaea Entomologica. VI.
1852 Winnertz. Stettiner Ent. Zeit. XIII. 50.
—— Wulp. See Van der Wulp.
*1842 Zeller. Isis. 807.
1838 Zetterstedt. Insecta Lapponica. Diptera. (1838–1840.)
1850 Zetterstedt. Diptera Scand. IX.
*1850 Zetterstedt. Diptera Scand. IX. 3476, 3483, 3653.
1852 Zetterstedt. Diptera Scand. XI.
1855 Zetterstedt. Diptera Scand. XII.
1860 Zetterstedt. Diptera Scand. XIV.

EXPLANATIONS TO THE PLATES

PLATE 1

The bull-frog, Rana catesbiana Shaw. Photo by Dr. J. L. Hancock

PLATE 2

Hemerobian wings

1 Wings of Hemerobius tutatrix Fitch.
2 Wings of Spadobius occidentalis Fitch.

PLATE 3

Hemerobian wings

1 Wings of Micromus insipidus Hagen.
2 Wings of Micromus jonas sp. nov.
3 Wings of Palmobius amiculus Fitch.

PLATE 4

Mayflies

1 Wings of subimago of Baetisca obesa Say. showing color pattern: 1, 2, 3, anal veins.
2 Lateral view of nymph of Baetisca obesa Say
3 Wings of imago of Ecdyurus maculipennis Walsh
4 Wings of imago of Heptagenia interpunctata Say

PLATE 5

Chirotenetes

1 Female imago of Chirotenetes albomanicatus sp. nov.
2 Wings of subimago of same
3 Lateral view of nymph of same
4 Dorsal view of nymph of same

PLATE 6

Chirotenetes

1 End of male abdomen of Chirotenetes albomanicatus sp.* nov. viewed from below; f, forceps; m, rudimentary median caudal seta
2 Labrum of nymph of same species
3 Labium of nymph of same
4 Mandible of nymph of same
5 Maxilla of nymph of same, with suboval gill tuft attached
6 Base of antenna of nymph of same
7 Fore leg of same, with coxal gill tuft attached
8 Hind leg of same
9 Claw of hind tarsus of same
10 Gill lamella of the fourth abdominal segment with gill tuft attached to its base on the under side

PLATE 7

Mayfly nymphs (photographed from alcoholic specimens)

1 Nymph of Ameletus ludens sp. nov.
2 Nymph of Choroterpes basalis Banks
3 Nymph of Ecdyurus maculipennis Walsh

*White fore torsi accidentally cut away in cutting out the back-ground.

4 Ventral view of nymph of Rhithrogena elegantula Etn.?
5 Dorsal view of the same
6 Ventral view of Iron sp? from Coy Glen near Ithaca
7 Dorsal view of the same

PLATE 8

Choroterpes and Ameletus

1 Wings of imago of Choroterpes basalis Banks
2 Abdominal appendages of the male imago of same, from below
3 Labium of nymph of the same
4 Maxilla of nymph of the same
5 Labrum of nymph of the same
6 Mandible of the nymph of the same
7 Gill filament of the first abdominal segment of the same
8 Gill lamellae of the fourth abdominal segment of the same
9 Venation of the wings of Ameletus ludens sp. nov.

PLATE 9

Mayfly nymphs (photographed from alcoholic specimens)

1 Three nymphs of Ephemerella excrucians Walsh, showing differences in depth of coloration; the left front foot of the left hand specimen has been lost and is regenerating
2 Nymph an unknown Ephemerella from Pecos New Mex.
3 Dorsal and ventral views of nymphs of Heptagenia interpunctata Say
4 Dorsal and ventral views of nymphs of Heptagenia sp? no. 3, from Ithaca N. Y.

PLATE 10

Drunella and Ephemerella

1 Venation of fore wing of nymph of Drunella grandis Etn.?
2 Venation of hind wing of same
3 Face of the nymph of same (male)
4 Claw of hind tarsus of same
5 Claw of hind tarsus of Ephemerella bispina sp. nov.
6 Lateral view of nymph of Drunella grandis Etn?, legs removed
7 Dorsal view of abdomen of nymph of Ephemerella sp? from Richfield Springs N. Y.
8 Male abdominal appendages of Ephemerella excrucians Walsh
9 Male abdominal appendages of Ephemerella sp? from Pecos N. Mex.
10 Male abdominal appendages of Ephemerella bispina sp. nov.

PLATE 11

Leptophlebia and Caenis

1 Venation of wings of Leptophlebia praepedita Etn.
2 Abdominal appendages of male of same, drawn from mounted slide, the ventral processes of the inner appendages somewhat turned aside by pressure of the coverglass
3 Venation of the wing of Caenis hilaris Say
4 Venation of the Wing of Caenis diminuta Walker

5 End of male abdomen of same from below
6 End of male abdomen of Caenis hilaris Say, from below. 3 and 4 to same scale; 5 and 6 to same scale

PLATE 12

Nymph of Polymitarcys albus Say

DRAWINGS BY W. E. HOWARD

1 Dorsal view of the nymph
2 Mandible
3 Maxilla
4 The right fore leg
5 Labium
6 Antenna
7 A gill from the fourth abdominal segment
8 Labrum

PLATE 13

1 Apex of abdomen of Hydroptila consimilis from beneath
2 Apex of abdomen of Hydroptila consimilis from above
3 Apex of abdomen of Hydroptila consimilis from side
4 Another view of penis of Hydroptila consimilis
5 Apex of abdomen of Hydroptila delineatus from beneath
6 Apex of abdomen of Hydroptila delineatus from side
7 Apex of abdomen of Hydroptila delineatus latero dorsal aspect
8 Apex of abdomen of Hydroptila spatulata from beneath
9 Dorsal of plate of Hydroptila spatulata from above (not quite satisfactory)
10 Apex of abdomen of Hydroptila spatulata from side
11 Apex of abdomen of Hydroptila hamata from beneath
12 Apex of abdomen of Hydroptila hamata from above
13 Apex of adbomen of Hydroptila hamata from side

PLATE 14

14 Apex of abdomen of Ithytrichia clavata from beneath (not satisfactory)
15 Apex of abdomen of Ithytrichia clavata from side
16 Apex of abdomen of Ithytrichia confusa from above
17 Apex of abdomen of Ithytrichia confusa latero ventral aspect
18 Apex of abdomen of Orthotrichia brachiata from beneath
19 Apex of abdomen of Orthotrichia brachiata from side (not satisfactory)
20 Apex of abdomen of Oxyethira coercens from beneath
21 Apex of abdomen of Oxyethira coercens from above
22 Apex of abdomen of Oxyethira coercens from side
23 Apex of abdomen of Oxyethira viminalis from beneath
24 Apex of abdomen of Neotrichia collata from beneath
25 Penis of Neotrichia collata
26 Apex of penis of Neotrichia collata, another view
27 Fore wing of Neotrichia collata
28 Hind wing of Neotrichia collata

PLATE 15

29 Head of Neotrichia collata
30 Apex of abdomen of Neotrichia collata from above
31 Apex of abdomen of Hydroptila perdita from beneath
32 Apex of abdomen of Hydroptila perdita from above
33 Apex of abdomen of Hydroptila perdita from side (somewhat crushed)
34 Penis of Hydroptila perdita
35 Apex of abdomen of Ithytrichia clavata from above
36 Dorsal plate of Hydroptila consimilis (dry example from Belfrage Texas)
37 Apex of abdomen of Oxyethira dualis from beneath
38 Apex of abdomen of Oxyethira dualis from above
39 Apex of penis of Oxyethira dualis

PLATE 16

Chironomus sp.

1 Adult male. x6
2 Pupa
3 Head of adult female
4 Larva (the second and third segments coalescent)
5 Frontal aspect of larval head

PLATE 17

Ceratopogon sens. lat.

1 Larva. x6
2 Hypopharynx of larva. x100
3 Caudal end of larva. x100
4 Ceratopogon sens. str. Larva. x10
5 Ceratopogon sens. str. Body segment of larva. x40
6 Ceratopogon sens. str. Mandible of larva. x180
7 Ceratopogon sens. str. Thoracic prolegs of larva. x400
8 Ceratopogon sens. str. Claw of hind proleg of larva. x400
9 Ceratopogon sens. str. Dorsal aspect of pupa. x15
10 Bezzia sp. Dorsal aspect of labium, maxilla and its palpus
11 Bezzia sp. Ventral aspect of pupa
12 Bezzia sp. Thoracic respiratory organ of pupa. x100
13 Brachypogon wing
14 Ceratopogon sens. str., wing
15 Bezzia wing
16 Sphaeromyas wing

PLATE 18

Ceratopogon sens. lat.

1 Dorsal aspect of labrum of larva; a, antenna; b, papilla. x400
2 Dorsal aspect of labium and maxilla of larva; p, palpus. x400
3 Lateral aspect of head of larva; m, mandible; a, antenna. x100

Bezzia setulosa

4 Mandible of larva. x400
5 Hypopharynx of larva. x400
6 Dorsal aspect of labium of larva. x400

Ceratopogon sens. str.

7 Foot of imago

Culicoides sp.

8 Foot of imago

Bezzia setulosa

9 Respiratory organ of pupa. x100
10 Dorsal aspect of pupa. x15
11 Ventral aspect of pupa. x15
12 Fore femur of imago. x40

Sphaeromyas argentatus

13 Fore fifth tarsal joint of female imago. x40
14 Hind fifth tarsal joint of female imago. x40

Bezzia setulosa

15 Antenna of male imago. x40
16 Antenna of female imago. x40

PLATE 19

Ablabesmyia flavifrons

1 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium. x100
2 Respiratory organ of the pupa. x50

Procladius pinguis

3 Respiratory organ of pupa. x50
4 Caudal appendage of pupa. x15

Ablabesmyia sp.

5 Labium of larva. x180

Ablabesmyia dyari

6 Caudal appendage of pupa. x15
7 Respiratory organ of pupa. x50

Ablabesmyia monilis

8 Pupa. x5
9 Larva. x5

Procladius adumbratus

10 Caudal end of larva. x50

Ablabesmyia monilis

11 A pale claw of the posterior proleg of larva. x100
12 A dark claw of the posterior prolegs of larva. x100
13 Respiratory organ of pupa. x40
14 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium; h, hypopharynx; x, lateral process. x100
15 Caudal appendage of pupa. x40

Ablabesmyia fastuosa

16 Mandible of larva. x100
17 Antenna of larva. x100
18 Respiratory organ of pupa. x40
19 Caudal appendage of pupa. x40

PLATE 20

Procladius adumbratus

1 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium; h, hypopharynx; x, lateral process. x180
2 Slender claw of posterior proleg. x180
3 Stout claw of posterior proleg. x180
4 Caudal appendage of pupa. x40
5 Respiratory organ of pupa. x100

Ablabesmyia carnea

6 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium; h, hypopharynx; x, lateral process. x180
7 Respiratory organ of pupa. x100
8 Caudal appendage of pupa. x40

Diamesa waltlii

9 Ventral aspect of the head: md, mandible; mx, maxilla; p, palpus; ulr, labrum; la, lateral arms; l, labium; hy, hypopharynx

Chironomus sens. lat. sp.

10 Dorsal aspect of head: ds, dorsal sclerite; a, antenna (wanting); b, frontal process

PLATE 21

Chironomus tenellus

1 Ventral aspect of head of larva: ulr, labrum; la, lateral arms; md, mandible; mx, maxilla; p, palpus; l, labium. x150
2 Caudal end of pupa. x60
3 Lateral aspect of the fifth abdominal segment of pupa. x60
4 Antenna of larva. x150

Chironomus nigricans

5 Antenna of larva. x150
6 Ventral aspect of head of larva: l, labium; hy, hypopharynx; mx, maxilla; imx, inner lobe of maxilla; p, palpus. x150
7 Mandible of larva. x150
8 Anterior prolegs of larva. x25
9 Posterior end of larva. x25
10 Epipharynx of larva: an, anterior comb; c, posterior comb. x250
11 Dorsal aspect of second and third abdominal segments of pupa. x25
12 Comb at caudal end of lateral fin of eighth segment of pupa. x60

Chironomus flavicingula

13 Ventral aspect of epipharynx of larva, distended: f, posterior comb; s, curved setae. x250
14 Ventral aspect of labrum: a, epipharynx (shown enlarged in fig.13). x150
15 Dorsal aspect of labrum. x250
16 Dorsal aspect of third segment of pupa. x25
17 Lateral fin of eighth segment of pupa. x60
18 Labium of larva. x150
19 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus; hy, hypopharynx

PLATE 22

Chironomus flavus

1 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; hy, hypopharynx; l, labium; f, fan-membrane. x150

2 Caudal end of larva: a, caudal setae; b, blood gills. x35

3 Lateral aspect of second and third abdominal segments of pupa. x35

4 Spur of lateral fin of eighth segment of pupa. x60

Tanytarsus deflectus

6 Respiratory organ of pupa. x100

Chironomus sp. (81)

7 Ventral aspect of mouth parts, labium and maxilla. x100

Chironomus modestus

8 Eighth segment and anal appendage of pupa. x50

9 Antenna of larva. x100

10 Labrum, ventral aspect: la, lateral arms. x100

11 Ventral aspect: l, labrum; md, mandible; mx, maxilla; p, palpus; f, fan-like membrane. x100

12 Dorsal aspect of fourth abdominal segment of pupa. x50

Tanytarsus sp.

13 Dorsal aspect of fourth abdominal segment. x40

Chironomus modestus var. b.

14 Dorsal aspect of posterior part of abdomen of pupa. x40

Chironomus modestus var. a.

15 Dorsal aspect of fourth segment of abdomen of pupa. x50

16 Lateral fin of the eighth abdominal segment of pupa. x50

Tanytarsus sp.

17 Lateral fin of the eighth abdominal segment of pupa. x40

18 Spur of the lateral fin; possibly of another species. x100

Chironomus fulviventris

19 Posterior comb of the epipharynx of the larva. x100

Chironomus (?) fulvus

20 Dorsal aspect of abdominal segment of pupa. x50

Chironomus sp. (84)

21 Labium of larva. x100

Chironomus sp. (82)

22 Labium of larva. x180

Chironomus (?) fulvus

23 Lateral fin of the eighth segment of pupa. x50

Chironomus fulviventris

24 Labium of larva. x100

25 Antenna of larva. x100

26 Lateral fin of the eighth abdominal segment of pupa. x100

PLATE 23

Chironomus dorsalis

1 Labium of larva (after Miall and Hammond, 1900). x100

Chironomus lobiferus

2 Antenna of larva. x100
3 Ventral aspect of larval head: l, labium; mx, maxilla; p, palpus; f, fan-like membrane. x100
4 Lobe of an abdominal segment of the imago. x100
5 Comb of the lateral fin of the eighth segment of the pupa. x400

Chironomus sp. (83)

6 Labium of larva. x180

Chironomus decorus

7 Mandible of larva. x150
8 Labium of larva. x100
9 Pupa. x6
10 Ventral aspect of labrum of larva: an, anterior comb; c, posterior comb; lr, lateral arm. x150
11 Dorsal aspect of second abdominal segment of pupa. x40
12 Anal end of pupa. x40
13 Labium of larva (of another variety or possibly species). x180

Chironomus (?) plumosus

14 Spur of the lateral fin of eighth segment of pupa. x100
15 Labium of larva. x180
16 Maxilla of larva: p, palpus. x180

PLATE 24

Cricotopus exilis

1 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus; hy, hypopharynx. x250
2 Ventral aspect of the labrum. x250
3 Caudal end of pupa. x60
4 Mandible of larva. x250

Cricotopus trifasciatus

5 Ventral aspect of mouth parts of larva, labium and maxilla. x150
6 Mandible of larva. x150
7 Lateral aspect of abdominal segments of pupa. x35
8 Respiratory organ of pupa. x150
9 Lateral hair-tuft of larva. x150
10 Caudal end of pupa with the caudal end of enclosed imago. x35

Orthocladius flavus

11 Hypopharynx of larva. x80
12 Ventral aspect of mouth parts of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium. x80
13 Respiratory organ of pupa. x60
14 Ventral aspect of labrum of larva: la, lateral arm. x250
15 Lateral aspect of the posterior end of the seventh abdominal segment of the pupa
16 Caudal end of pupa. x25
17 Larval case, natural size

Orthocladius nivoriundus

18 Ventral aspect of labrum of larva: la, lateral arm. x150
19 Antenna of larva. x150
20 Mandible of larva. x150
21 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; hy, hypopharynx. x150
22 Dorsal aspect of abdominal segment of pupa. x80
23 Respiratory organ of pupa. x60
24 Caudal appendage of pupa. x35

PLATE 25

Orthocladius fugax

1 Mandible of larva. x150
2 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus; hy, hypopharynx
3 Latero-ventral aspect of labrum of larva: a, antenna; ep, epipharynx; c, lateral arm. x150
4 Respiratory organ of pupa. x150
5 A pectinate hair from anterior prolegs of larva. x400
6 Caudal end of larva. x60
7 Lateral aspect of second, third and fourth abdominal segments of pupa. x60
8 Claw of posterior proleg of larva. x250
9 Peripheral claw of posterior proleg of larva. x250
11 Dorsal aspect of fifth abdominal segment of pupa

Orthocladius sordidellus

12 Ventral aspect of labrum of larva. x180
13 Antenna of larva. x180
14 Ventral aspect of mouth parts of larva: l, labium; md, mandible; mx, maxilla; p, palpus; lr, labrum. x250
15 Lateral aspect of abdominal segment of pupa. x150

Tanytarsus dissimilis

16 Ventral aspect of mouth parts of larva: l, labium; md, mandible; mx, maxilla; p, palpus; lr, labrum. x250
17 Antenna of larva. x250
18 Dorsal aspect of abdomen of pupa of variety a. x60
19 Comb of the lateral fin of the eighth segment of pupa. x250
20 Dorsal aspect of the abdomen of pupa. x60
21 Comb of lateral fin of eighth segment of pupa. x250

Cricotopus varipes

22 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus

PLATE 26

Tanytarsus dives

1 Dorsal aspect of head of larva: a, antenna; lr, labrum. x60
2 Apical end of mandible of larva. x150
3 Respiratory organ of pupa. x60
4 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus: imx, inner lobe of maxilla; hy, hypopharynx. x250

5 Caudal end of larva. x25
6 Caudal end of pupa. x25
7 Dorsal aspect of abdominal segments of pupa. x25

Tanytarsus exiguus

8 Larva. x20
9 Fibrous case of larva and pupa. x6
11 Dorsal aspect of second abdominal segment of pupa. x100
12 Ventral aspect of mouth parts of larva: l, labium; md, mandible; mx, maxilla; p, palpus. x400
13 Antenna of larva. x250
14 Latero-ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; l, labium
15 Caudal end of pupa (male). x100

PLATE 27

1 Procladius pusillus
2 Procladius caliginosus
3 Procladius pinguis
4 Procladius scapularis
5 Ablabesmyia carnea var. c.
6 Ablabesmyia monilis
7 Tanypus stellatus
8 Ablabesmyia venusta
9 Ablabesmyia dyari
10 Ablabesmyia melanops
11 Ablabesmyia flavifrons
12 Ablabesmyia indecisa
13 Ablabesmyia indecisa (after Williston)
14 Ablabesmyia pallens, var. a.
15 Tanypus culiciformis
16 Chasmatonotus bimaculatus

PLATE 28

1 Chironomus brachialis
2 Chironomus scalaenus
3 Chironomus spilopterus (after Williston)
4 Chironomus taeniapennis
5 Chironomus caliginosus
6 Chironomus flavicingula
7 Chironomus halteralis
8 Chironomus fallax
9 Chironomus riparius
10 Chironomus barbipes
11 Chironomus annularis
12 Chironomus albimanus (male)
13 Chironomus albimanus (female)
14 Chironomus devinctus
15 Chironomus nigricans
16 Chironomus pedellus
17 Chironomus aberrans

18 Chironomus fumidus
19 Chironomus fulvus
20 Chironomus flavus

PLATE 29

1 Chironomus modestus var. a. female
2 Chironomus modestus var. a. female
3 Chironomus modestus var. b. male
4 Chironomus modestus female
5 Chironomus pallidus
6 Chironomus fulviventris
7 Chironomus frequens
8 Chironomus dux
9 Chironomus viridicollis
10 Chironomus longimanus (after Williston)
11 Chironomus plumosus
12 Chironomus decorus
13 Chironomus similis
14 Chironomus cristatus
15 Cricotopus trifasciatus
16 Cricotopus exilis
17 Cricotopus bicinctus
18 Cricotopus varipes
19 Cricotopus sylvestris
20 Cricotopus debilis (after Williston)

PLATE 30

1 Camptocladius sp.
2 Camptocladius fumosus
3 Camptocladius byssinus
4 Camptocladius minimus
5 Orthocladius sordens
6 Orthocladius flavus
7 Orthocladius sordidellus
8 Orthocladius nivoriundus
9 Orthocladius absurdus
10 Orthocladius fugax
11 Orthocladius obumbratus
12 Thalassomyia fusca
13 Diamesa waltlii
14 Tanytarsus obediens
15 Tanytarsus gmundensis
16 Tanytarsus deflectus
17 Tanytarsus dives
18 Tanytarsus fatigans
19 Tanytarsus fulvescens
20 Tanytarsus muticus
21 Tanytarsus flavellus

PLATE 31

1 Metriocnemus flavifrons
2 Metriocnemus par
3 Metriocnemus lundbeckii
4 Metriocnemus exagitans
5 Metriocnemus atratulus
6 Chasmatonotus bimaculatus (head of male)
7 Diamesa waltlii (antenna of female)
8 Orthocladius absurdus (antenna of female)
9 A part of an egg string of Sphaeromyas argentatus
10 An egg mass of Chironomus sp. x2
11 An egg mass of Tanypus sp. (after Miall)
12 A part of an egg string of Chironomus sp.
13-14 A part of the egg string of Chironomus dorsalis (after Miall and Hammond)
15 A part of an egg string of Chironomus sp.
16 Dorsal aspect of thorax of a male Chasmatonotus bimaculatus. x40

PLATE 32

Genitalia: d, dorsal keel; l, lateral; s, superior; i, inferior lobe
1 Bezzia setulosa. Dorsal aspect. Male. x100
2 Tanypus culiciformis. Male. x100
3 Ablabesmyia monilis. Male. x100
4 Corynoneura celeripes (after Kieffer)
5 Diamesa praecox (after Kieffer)
6 Chasmatonotus bimaculatus. Dorsal aspect. Male. x50
7 Chironomus flavicingula. Dorsal aspect. Male. x100
8 Chironomus modestus. Dorsal aspect. Male. x100
9 Chironomus modestus var. b. Latero-ventral aspect. Male. x100
10 Chironomus fulviventris. Male. x100
11 Chironomus modestus. Female. x100
12 Chironomus flavus. Ventral aspect. Male. x100
13 Chironomus decorus. Dorsal aspect. Male. x100
14 Diamesa waltlii. Dorsal aspect. Male. x50

PLATE 33

Genitalia: d, dorsal keel; l, lateral lobe; s, superior lobe; i, inferior lobe; a, appendage of the superior lobe
1 Orthocladius kervilli (after Kieffer)
2 Cricotopus exilis. Male. x100
3 Tanytarsus dissimilis. Ventral aspect. Male. x150
4 Tanytarsus exiguus. Ventral aspect. Male. x350
4a Tanytarsus exiguus. Male. Latero-ventral aspect. x100
5 Tanytarsus dives. Male. Dorsal aspect. x100
6 Metriocnemus par. Male. Lateral aspect. x100
7 Orthocladius absurdus. Lateral aspect. Female. x100
8 Metriocnemus atratulus (after Kieffer)

PLATE 34

Compontia cruciformis (=Thalassomyia frauenfeldii?)

1 Dorsal aspect of larva (after Theobald, 1892)

Hydrobaenus lugubris (after Fries)

2 Dorsal aspect of head of larva
3 Anterior prolegs of larva
4 Lateral aspect of larva
5 Lateral aspect of pupa
6 Antenna of female
7 Antenna of male
8 Caudal appendage of pupa
9 Wing of imago
10 Male genitalia
11 Lateral aspect of male clasper

Telmatogeton St Pauli (after Schiner)

12 Lateral aspect of larva.
13 Anterior prolegs of larva
14 Lateral aspect of pupa
15 Caudal sucker of pupa
16 Wing of imago

Orthocladius ? oceanicus (after Packard)

17 Ventral aspect of larval head
18 Posterior prolegs of larva
19 Anterior proleg of larva

Wulpiella scirpi (after Kieffer)

20 Wing of imago
21 Dorsal aspect of larva
22 Anterior proleg of larva
23 Ventral aspect of head of larva

Eurycnemus sp.

24 Lateral aspect of male (after Van der Wulp.)

PLATE 35

Macropeza

1 Anterior part of wing of imago (after V. d. Wulp)
2 Wing of imago (after Meigen)
3 Antenna of imago (after Meigen)

Psamathiomyia pectinata (after Deby)

4 Wing of male
5 Wing of female
6 Antenna
7 Haltere of male
8 Leg of male
9 Dorsal aspect of head and thorax

Tersesthes torrens (after Townsend)

10 Wing of imago
12 Palp of imago
13 Antenna of imago

Leptoconops (after Skuse)

14 Wing of adult

Eretmoptera (after Kellogg)

15 Foot of imago
16 Palp of imago
17 Labium of imago
18 Hypopharynx of imago
19 Labium-epipharynx of imago
20 Haltere of imago
21 Dorsal aspect of the male
22 Antenna of male
23 Antenna of female
24 Male genitalia

Didymorphleps (after Weyenbergh)

25 Wing of imago

Burmeisteria (after Weyenbergh)

26 Wing of imago
27 Lateral aspect of head and thorax of male
28 Haltere

Stenoxenus (after Coquillett)

29 Wing of female

PLATE 36

Corynoneura lemnae (after Frauenfeld)

1 Lateral aspect of larva
2 Anterior prolegs of larva
3 Posterior prolegs of larva
4 Caudal end of pupa
5 Lateral aspect of pupa

Corynoneura sp. (after Winnertz)

6 Hind leg of imago
7 Wing of imago
8 Palpus of imago
9 Antenna of male
10 Antenna of female

Clunio marinus

11 Lateral aspect of larva (after Carpenter)
12 Dorsal aspect of male (after Theobald)
13 Dorsal aspect of female (after Carpenter)

Diamesa culicoides (after Heeger except fig.14)

14 Lateral aspect of larva (after Brauer)
15 Dorsal aspect of larva
16 Ventral aspect of pupa
17 Lateral aspect of pupa
18 Mandible of larva
19 Labium of larva
20 Maxilla of larva
21 Labrum of larva
22 Antenna of larva
23 "Underlip" (i. e. hypopharynx) of larva
24 Claw of hind foot of larva
25 Anterior proleg of larva

Doloplastus (after Skuse)

26 Wing of imago

PLATE 37

Limnophyes (after Verrall)

1 Dorsal aspect of female
2 Mouth parts of female
3 Antenna
4 Lateral aspect of head and thorax

Halirytus (after Verrall)

5 Fore leg of female
6 Lateral aspect of female
7 Antenna of female

Heteromyia (after Say)

8 Wing of imago
9 Fore leg of imago

Podonomus (after Philippi)

10 Antenna
11 Wing of imago

Procladius (after Skuse)

12 Wing of imago

Spaniotoma (after Philippi)

13 Wing of adult
14 Antenna

Isoplastus (after Skuse)

15 Wing of imago

Pentaneura (after Philippi)

16 Wing of imago

Ablabesmyia pulchripennis (after Lundbeck)

17 Wing of imago

Tetraphora (after Philippi)

18 Wing of imago
19 Antenna of imago

Tanypus posticalis (after Lundbeck)

20 Wing of imago

Heptagyia (after Philippi)

21 Wing of imago
22 Antenna of imago
23 Palpus of imago

Procladius nervosus (after V. d. Wulp)

24 Wing of imago

Chironomus prasinus

25 Labium of larva (after Hammond)

Chironomus sp.

26 Labium of larva (after Osborn)

Chironomus tentans (after Weyenbergh)

27 Labium of larva
28 Apex of mandible of larva

LEGENDA TO TEXT FIGURES

Fig. 1 Venation of the wings of Siphlurus; lettering explained in text. p.20

Fig. 2 Wings of Callibaetis. p.21

Fig. 3 Venation of the fore wing of Ephemera. p.22

Fig. 4 The nymphal labium of Baetisca obesa Say. (The two muscle bands indicated by dotted lines in the basal segment of the left palpus are the same that move the lateral lobe of the dragonfly labium). p.30

Fig. 5 Ameletus ludens sp. nov., female subimago; u, end of abdomen from below, showing truncate apical lobe of the 9th sternum; v, fore tibia and tarsus. p.36

Fig. 6 Parts of nymph of Ameletus ludens sp. nov.; y, maxilla; z, single gill lamella from one of the middle abdominal segments. p.37

Fig. 7 Gill lamellae of the nymph of Blasturus cupidus Say; e, from the 1st segment; f, from the 4th segment; g, from the 7th segment. p.41

Fig. 8 Venation of wing of ?Caenis allecta sp. nov. p.48

Fig. 9 Ventral view of male abdominal appendages of ? Caenis allecta sp. nov., imago. p.48

Fig. 10 Ventral view of male abdominal appendages of Ecdyurus maculipennis Walsh, imago; f, forceps; i, inner appendages. p.51

Fig. 11 Tarsal claws of nymphs of Heptageninae; w, of Heptagenia interpunctata Say; x, of Rhithrogena elegantula Etn.?; y, of Iron sp? from Coy Glen, Ithaca; z, of Ecdyurus maculipennis Walsh; hind claws in each case; middle ones would be similar; front ones sometimes different. p.52

Fig. 12 Labra of nymphs of Heptageninae; h, of Iron sp? from Coy Glen, Ithaca; i, of Rhithrogena elegantula Etn.?; j, of Ecdyurus maculipennis Walsh; k, of Heptagenia interpunctata Say. p.52

Fig. 13 Mandibles of nymphs of Heptageninae; c, of Rhithrogena elegantula Etn.?; d, of Iron sp? from Coy Glen, Ithaca; e, of Ecdyurus maculipennis Walsh; f, of Heptagenia interpunctata Say. p.52

Fig. 14 Maxillae of nymphs of Heptageninae; m, of Iron sp? from Coy Glen, Ithaca; n, of Heptagenia interpunctata Say; o, of Rhithrogena elegantula Etn.?; p, of Ecdyurus maculipennis Walsh. p.53

Fig. 15 Hydroptilid structures: Agraylea multipunctata; 40, apex of abdomen from beneath; 41, same from side; 42, triangular pieces from side; 43, same when much exserted; 44, ventral lamina; Orthotrichia americana (?); 45, apex of abdomen from beneath. p.73

Fig. 16 Ventral aspect of larval mouth parts of Metriocnemus knabi. x180. p.306

Fig. 17 Dorsal aspect of caudal end of pupa of Metriocnemus knabi. x180. p.306

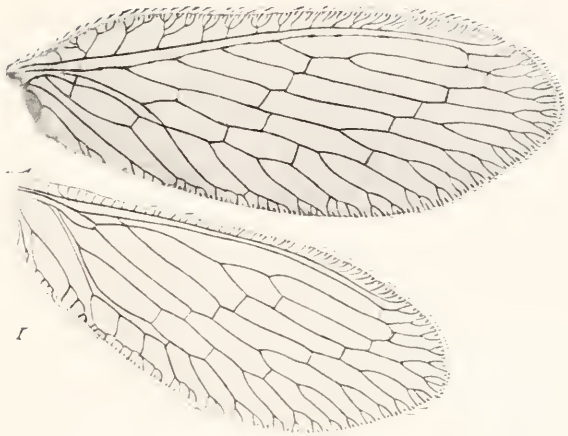
Fig. 18 Mandible and labium; larva A, x400; larva B, x180. p.309

Plate 1

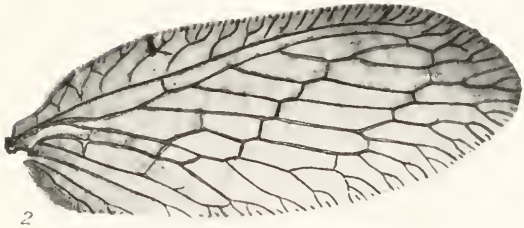
Bullfrog

Plate 2

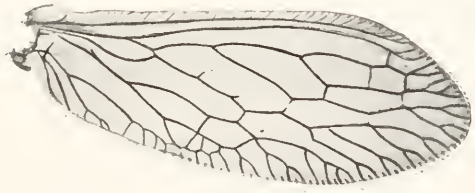
Hemerobian wings

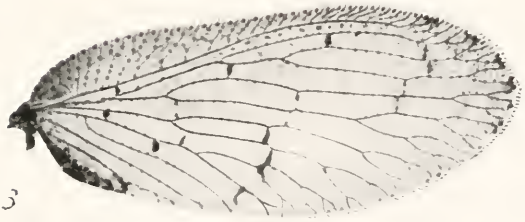


1



2





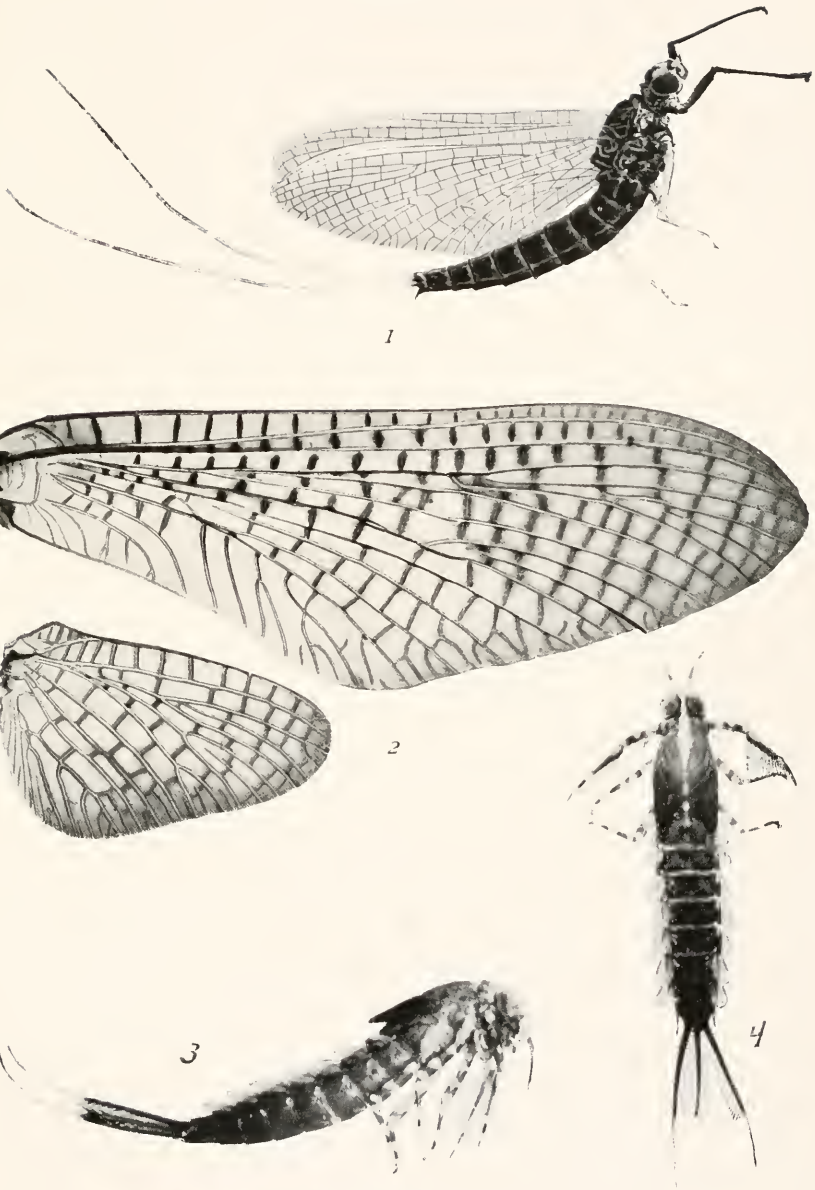
3

Hemerobian wings

Plate 4

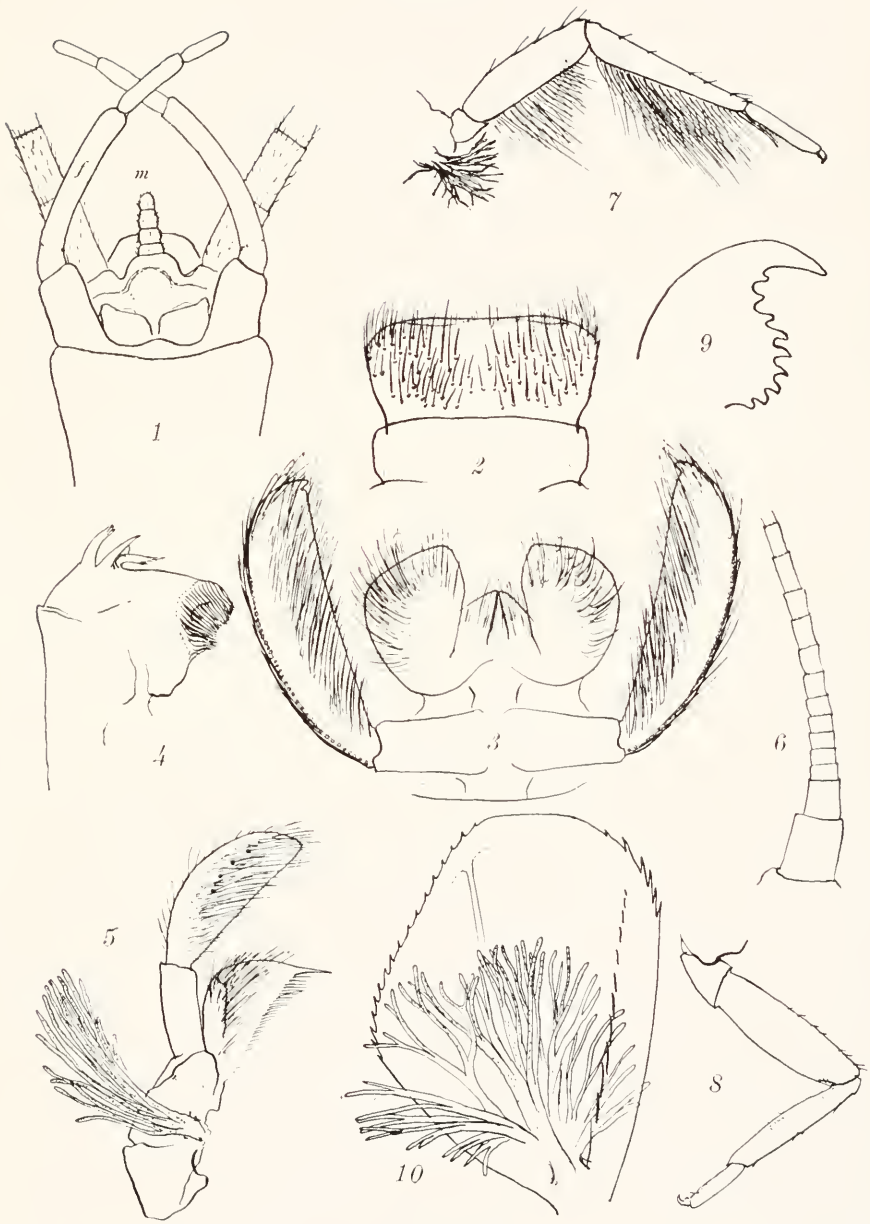
May fly structures

Plate 5



Chirotenetes
The white-gloved howdy

Plate 6

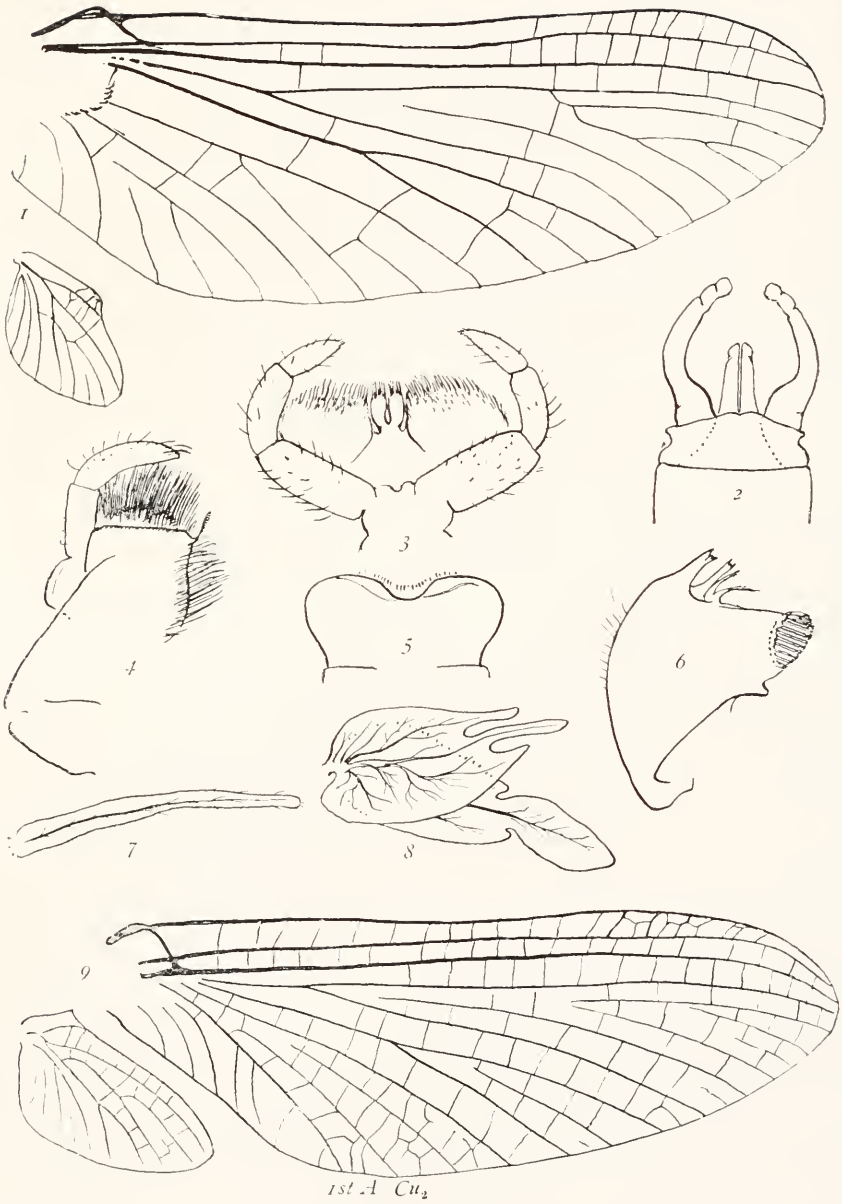


Chirotenetes

Plate 7

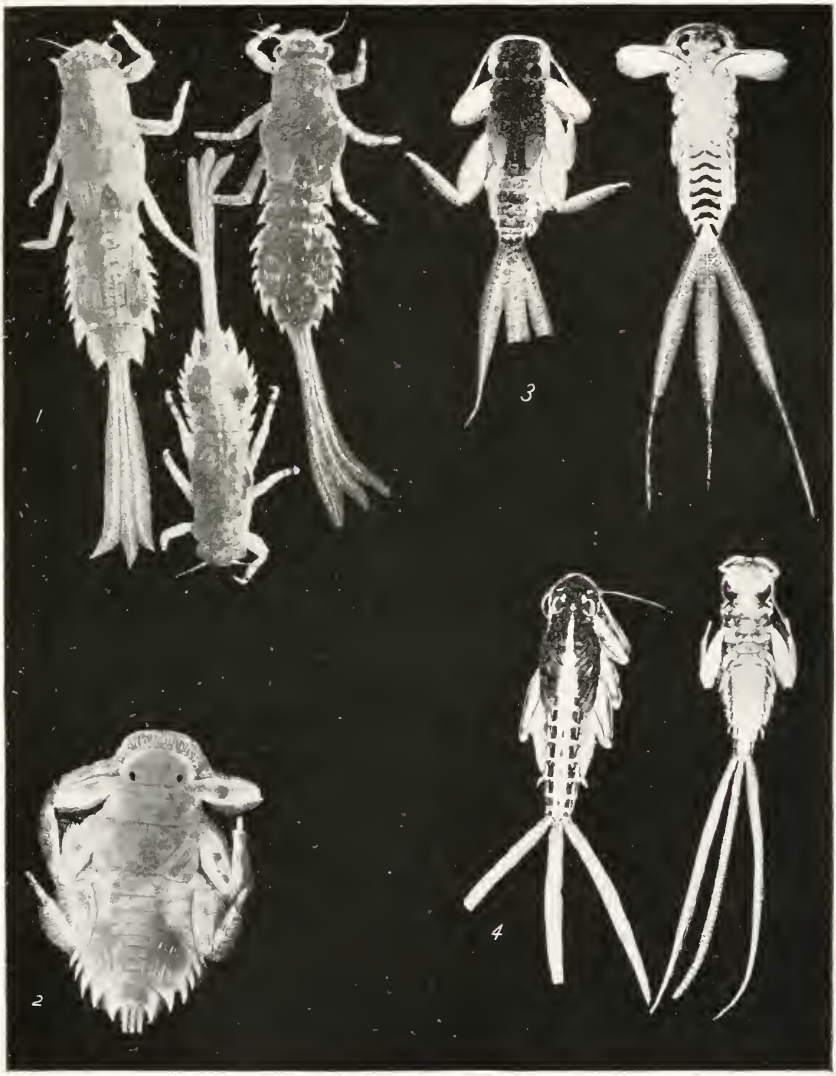
May fly nymphs

Plate 8



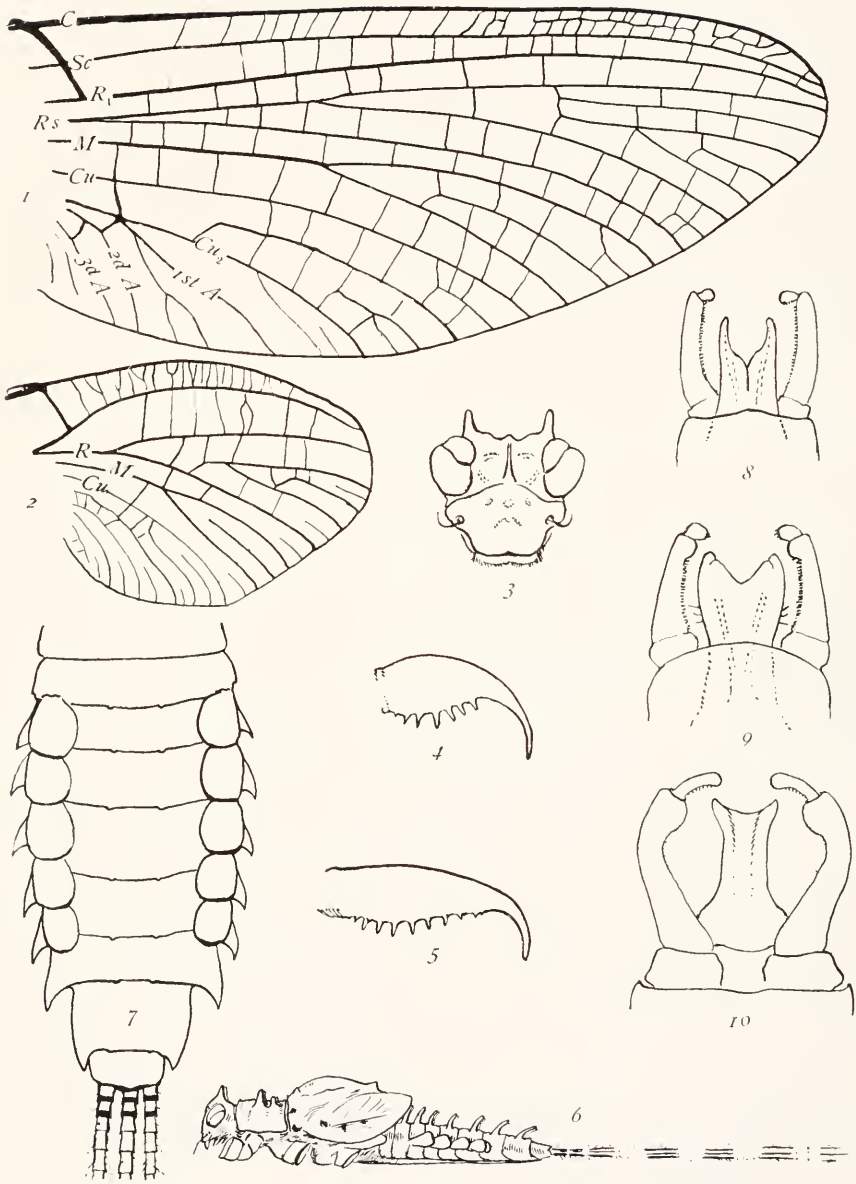
Choroterpes and Ameletus

Plate 9



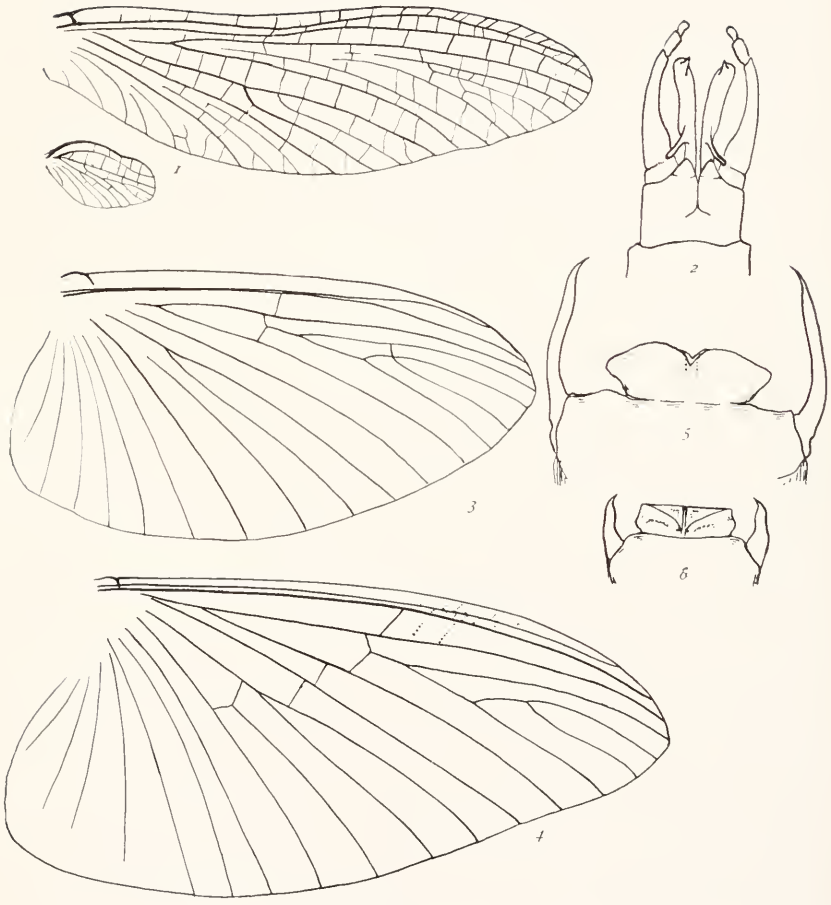
May fly nymphs

Plate 10



Drunella and Ephemerella

Plate 11

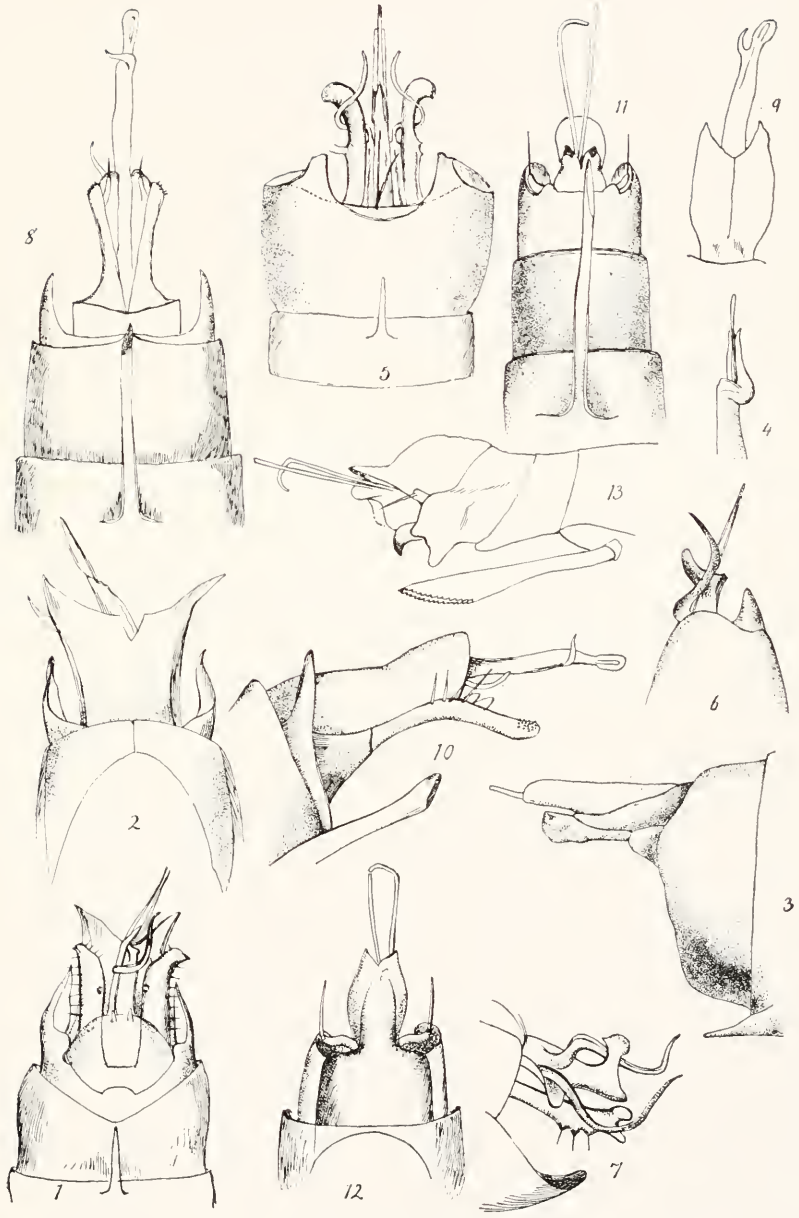


Leptophlebia and Caenis

Plate 12

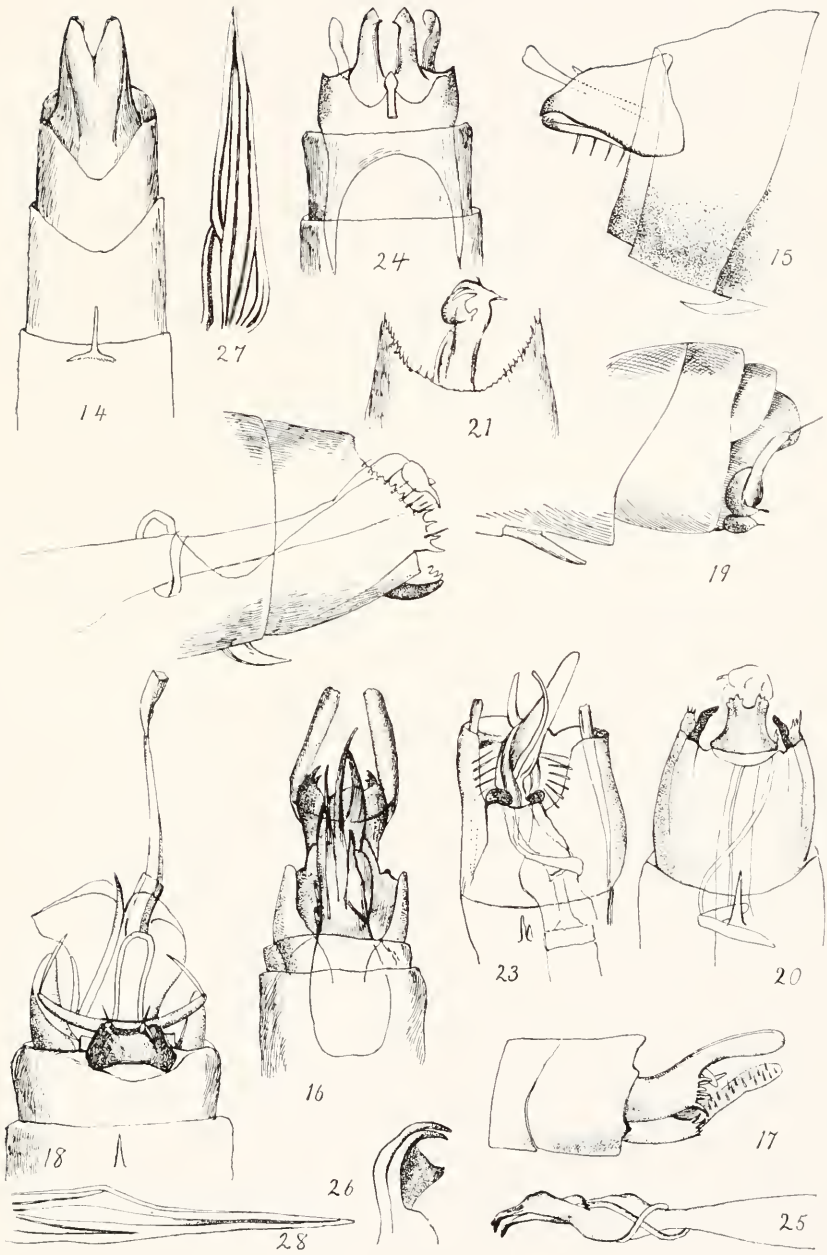
Polymitarcys albus

Plate 13



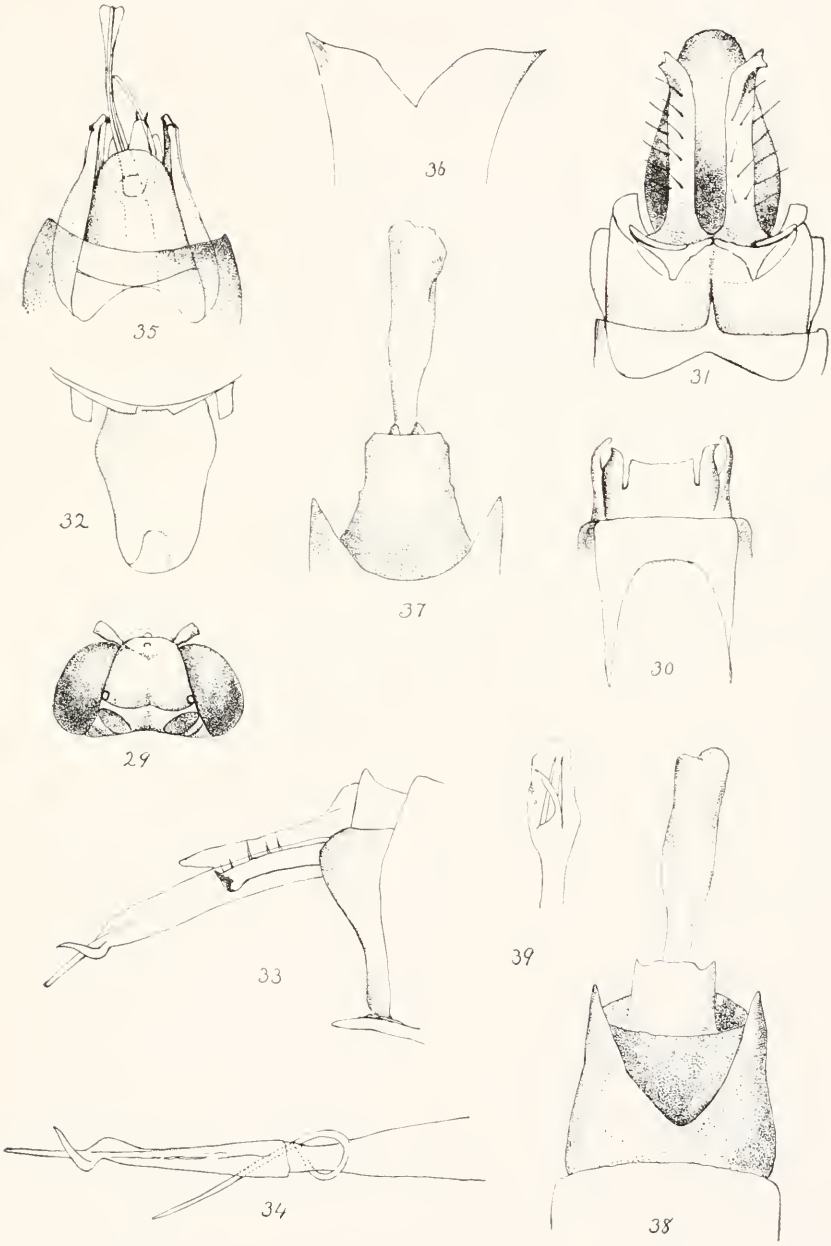
Hydroptilid structures

Plate 14



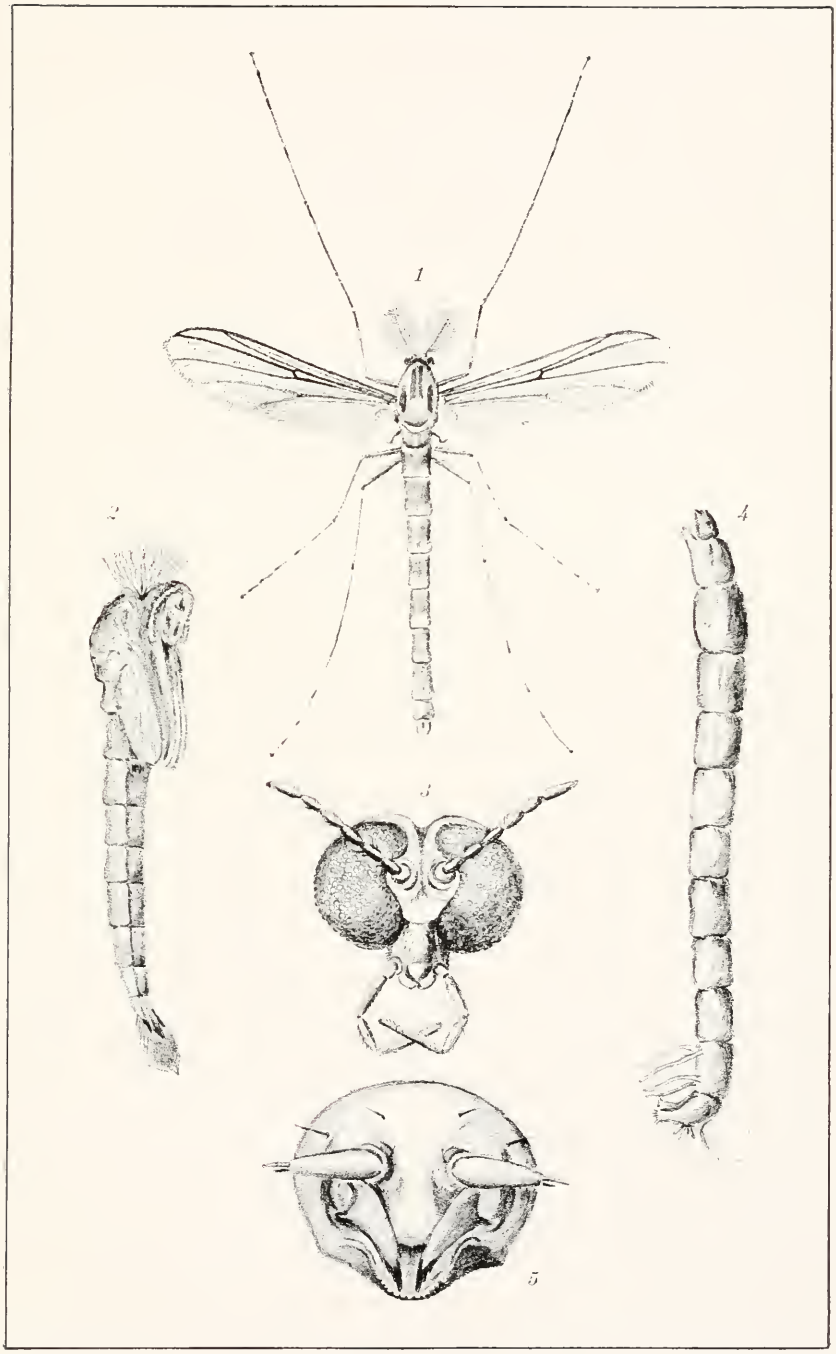
Hydroptilid structures

Plate 15



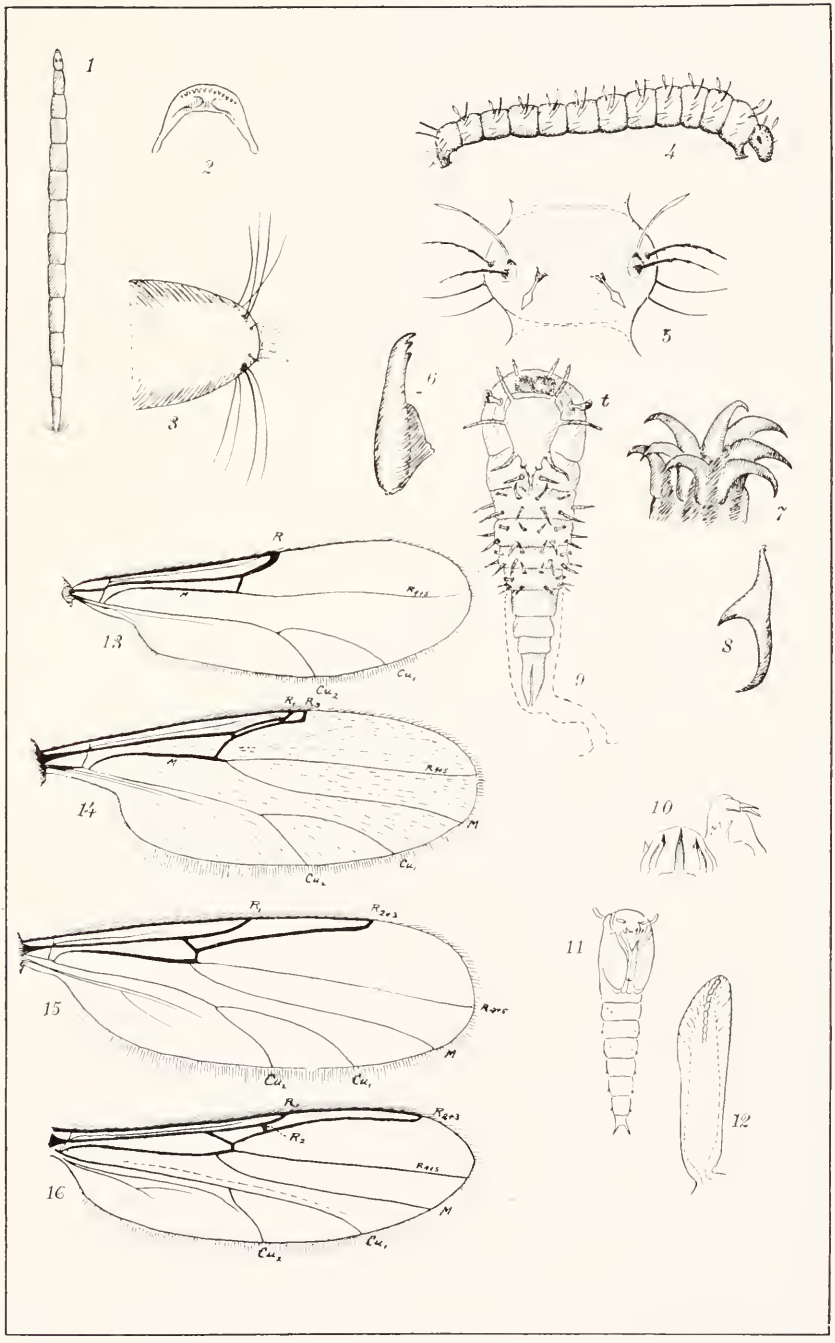
Hydroptilid structures

Plate 16



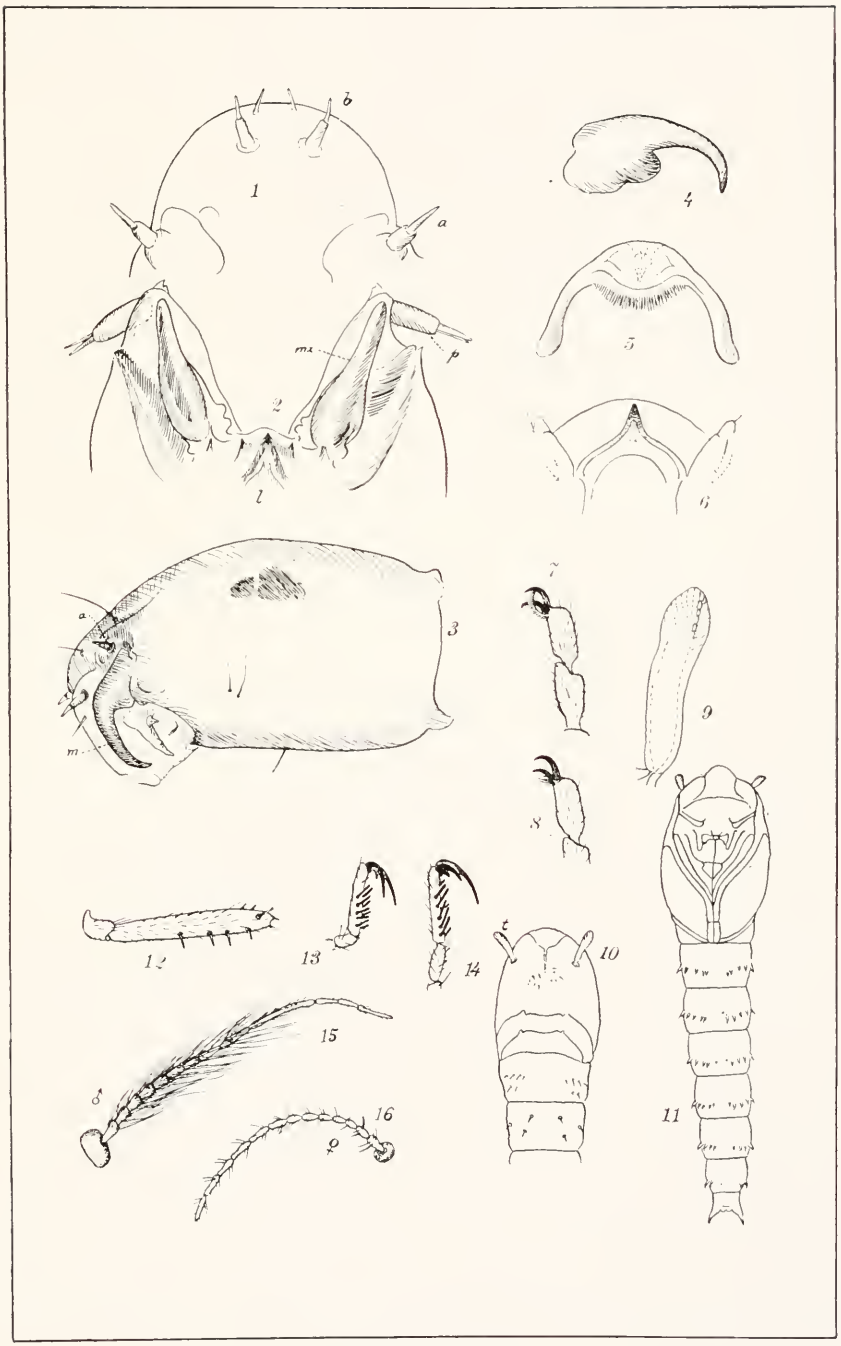
Chironomus

Plate 17

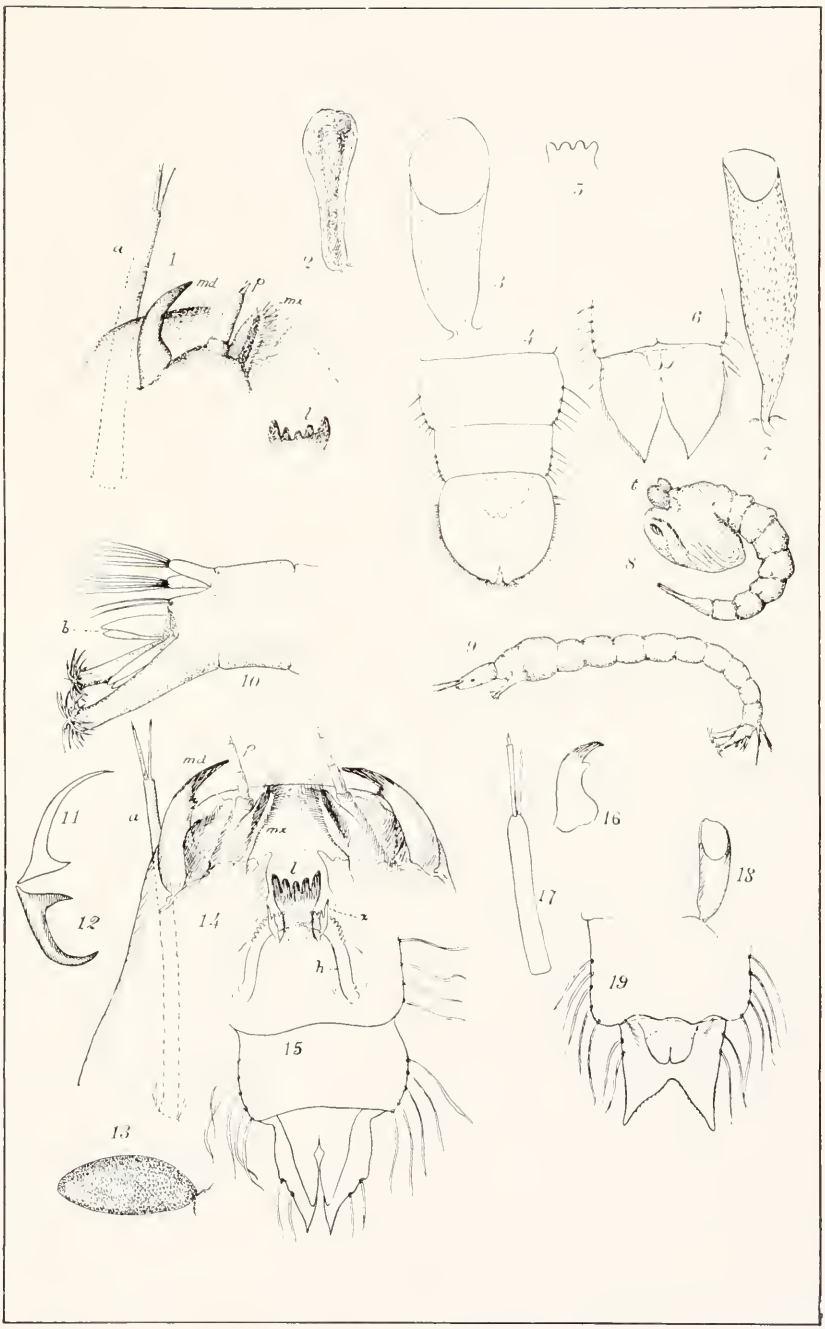


Ceratopogon group

Plate 18

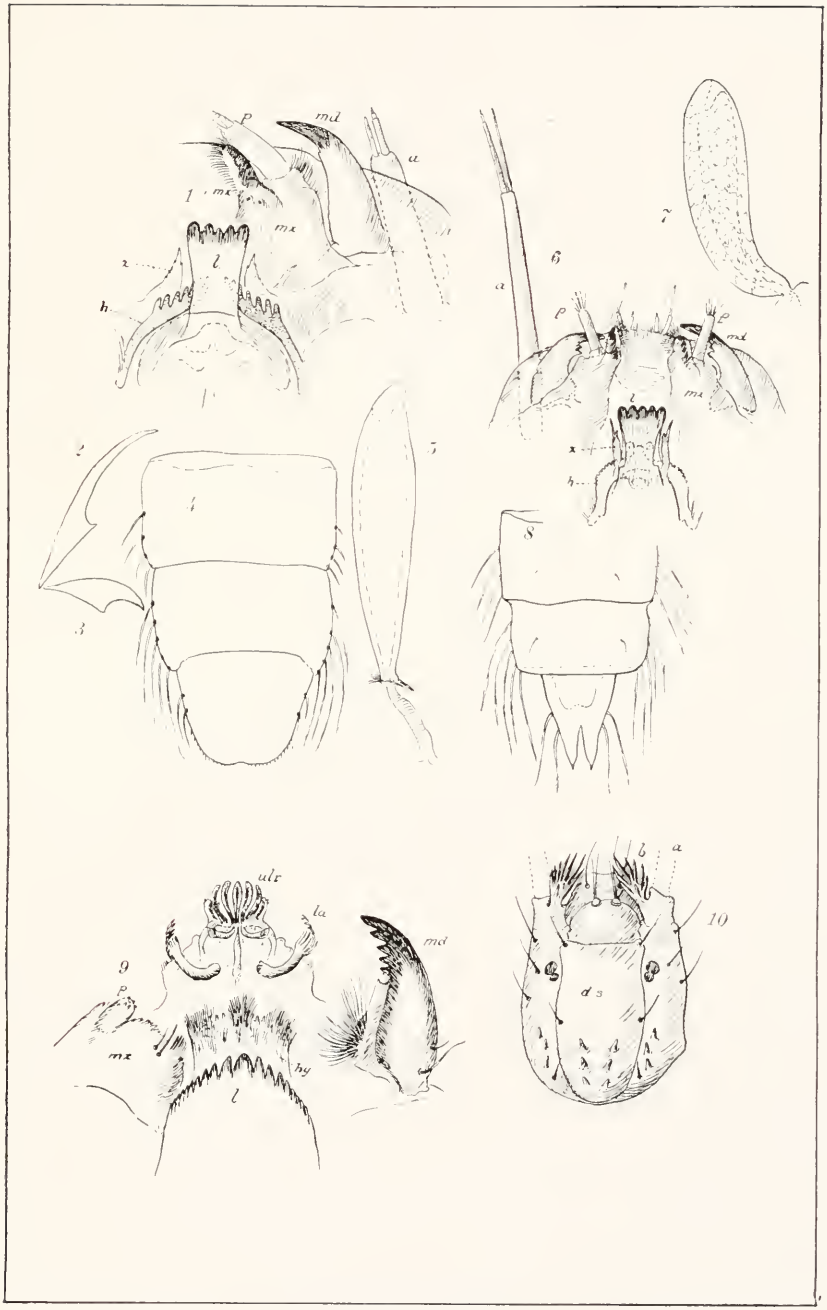


Ceratopogon group



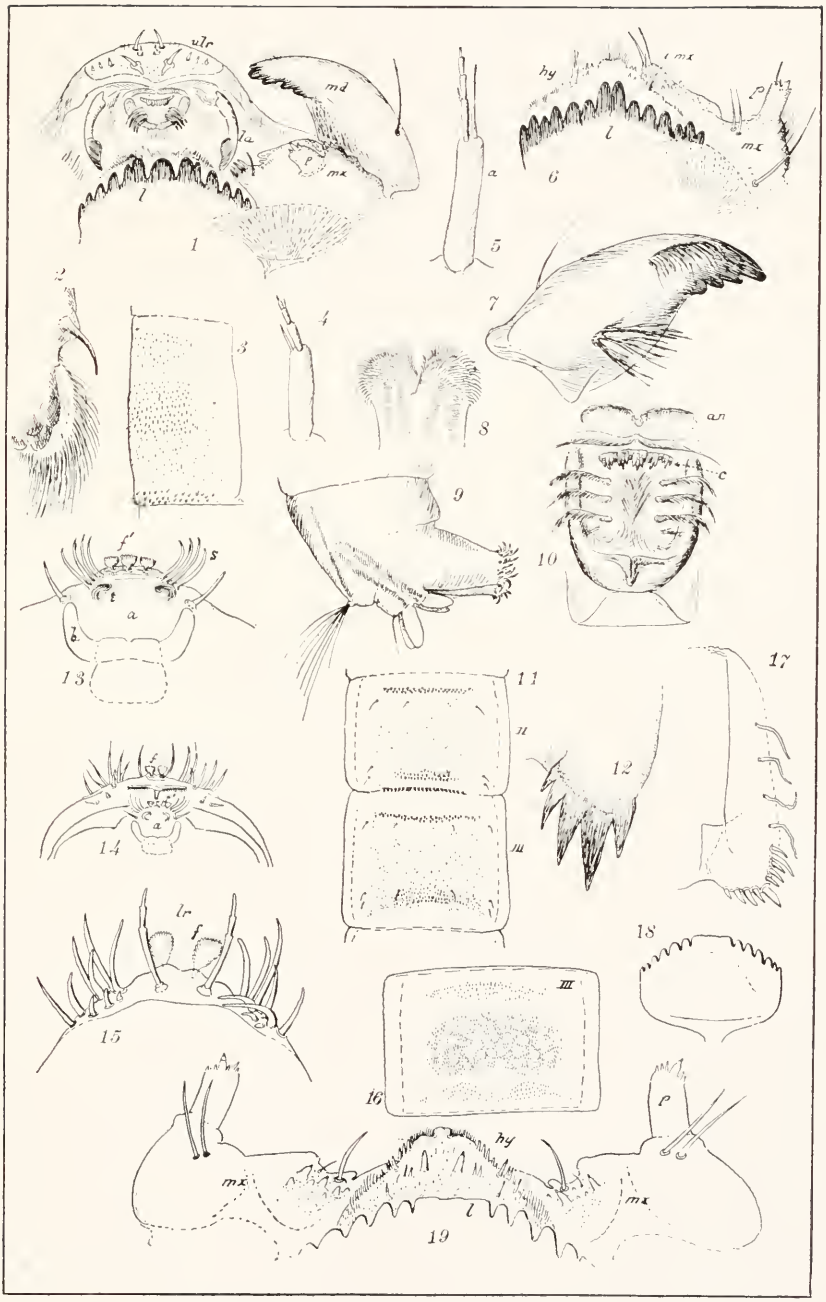
Tanypus group

Plate 20



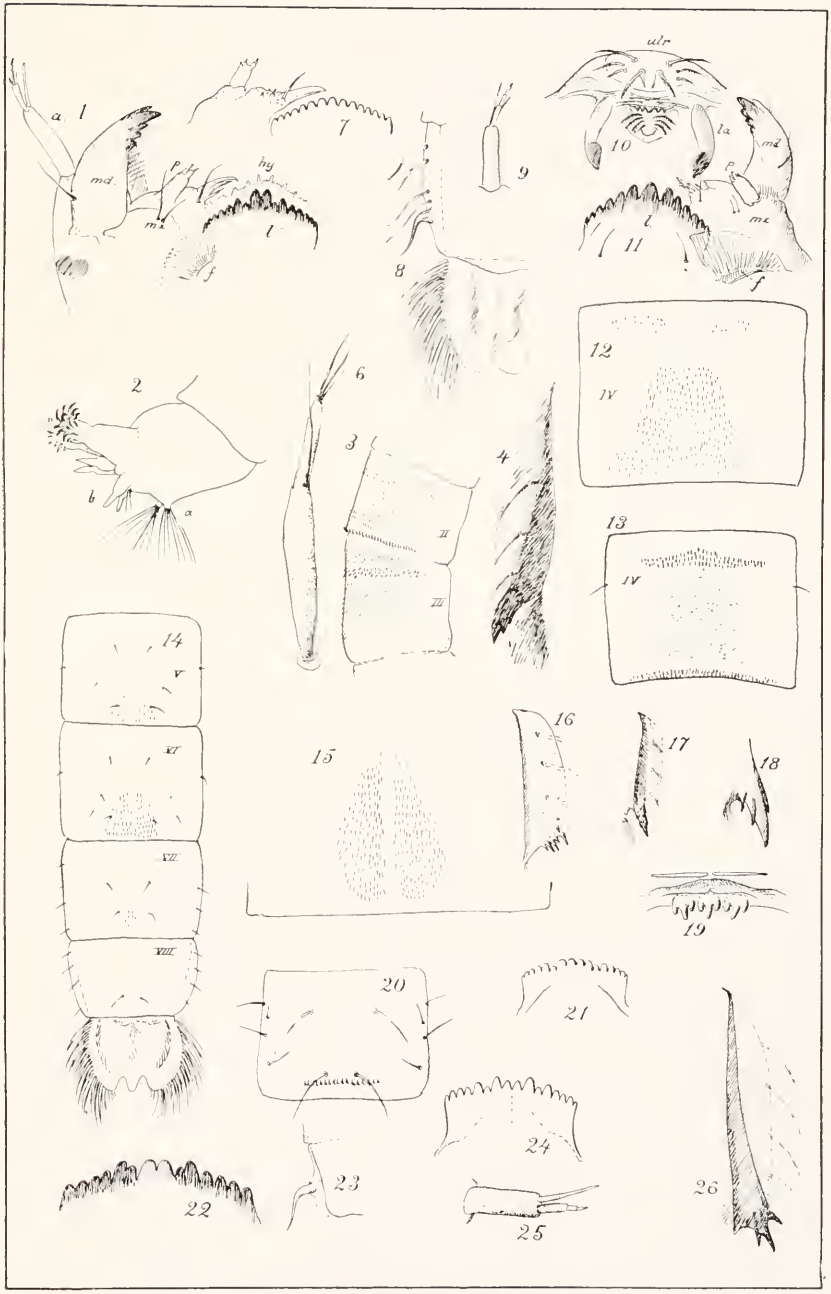
Tanypus group and others

Plate 21



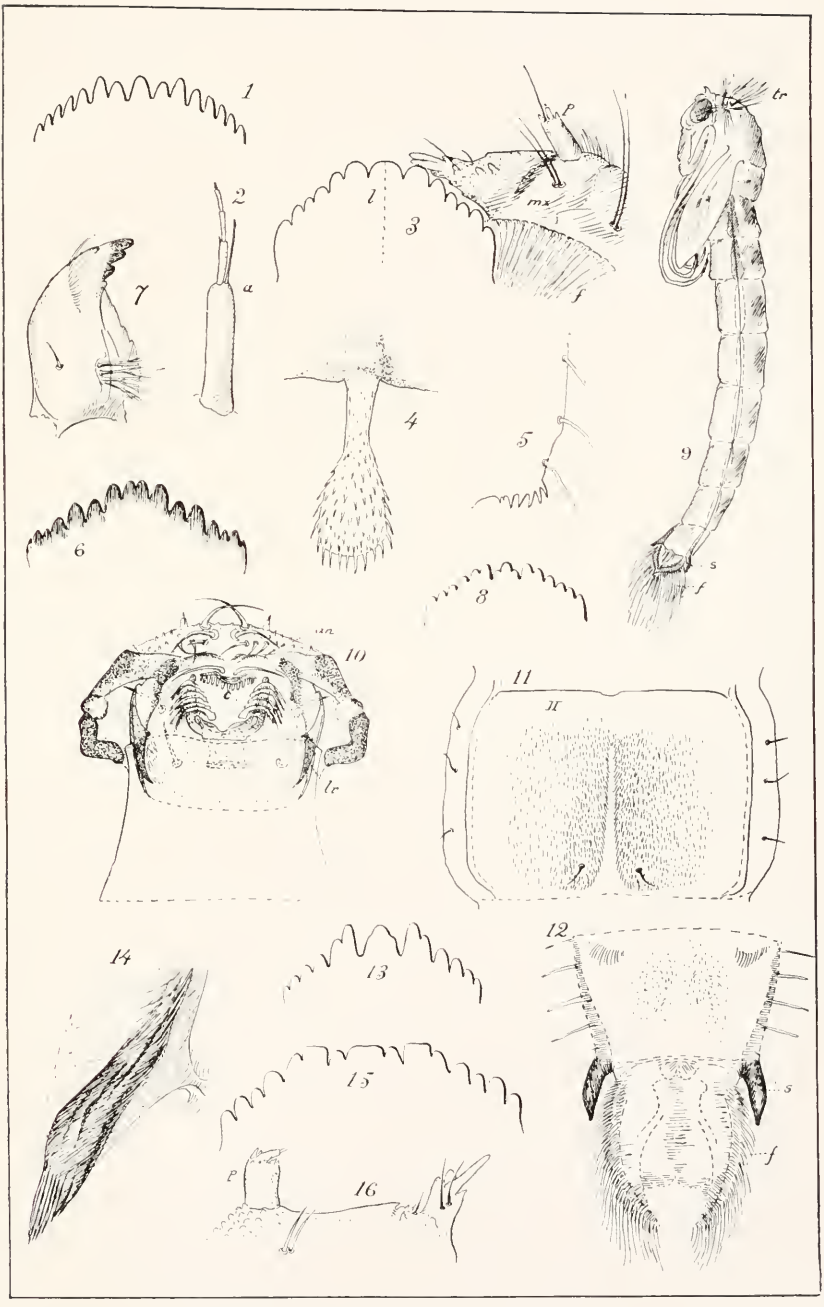
Chironomus: details of larva and pupa

Plate 22

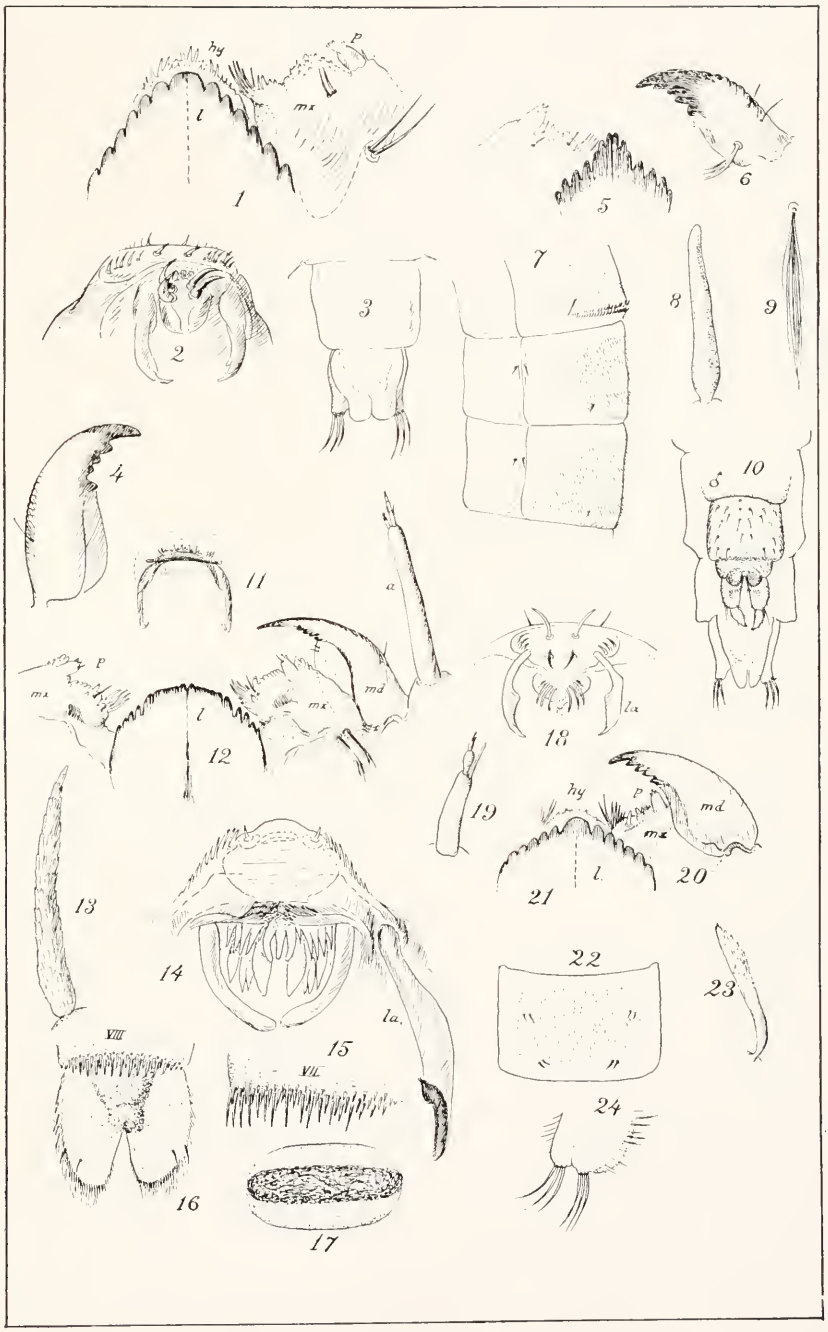


Chironomus: details of larva and pupa

Plate 23

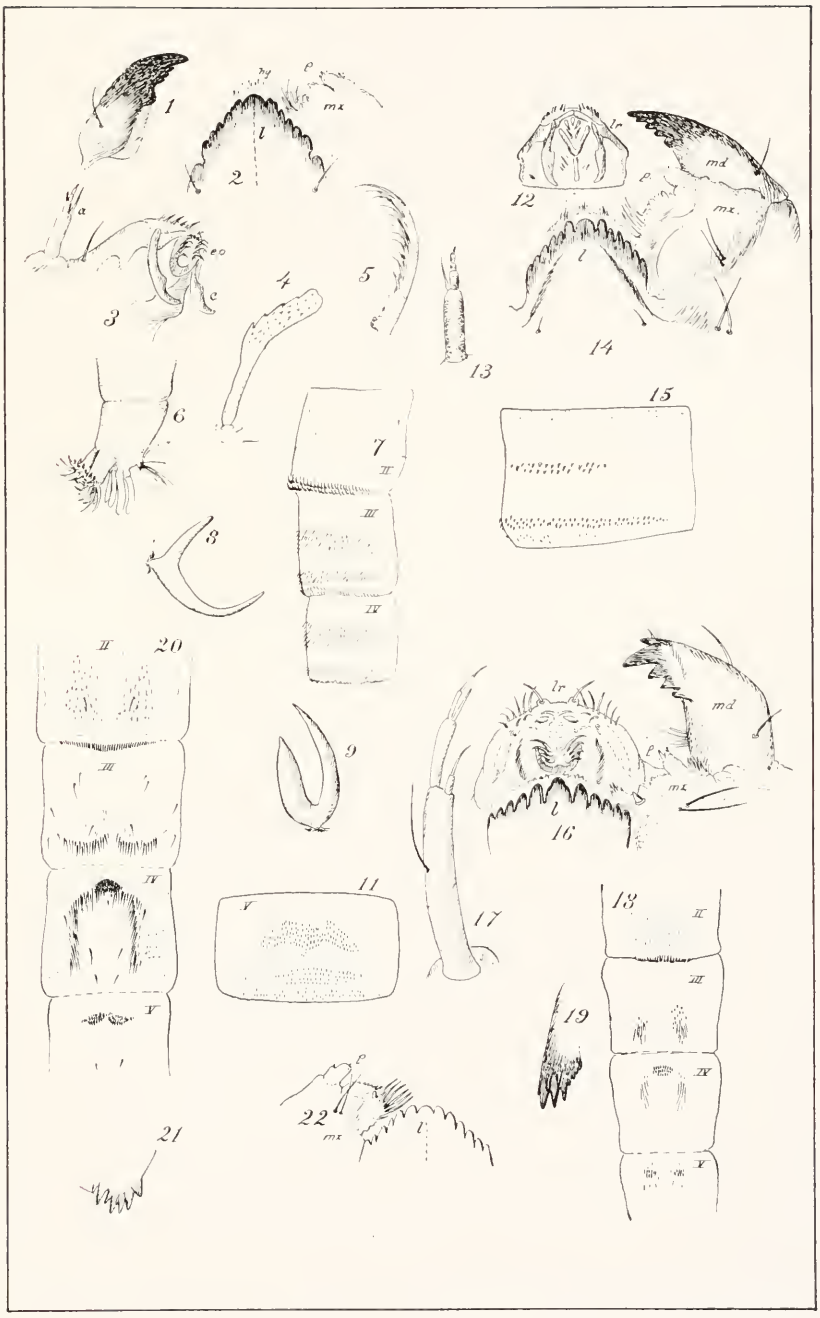


Chironomus: details of larva and pupa



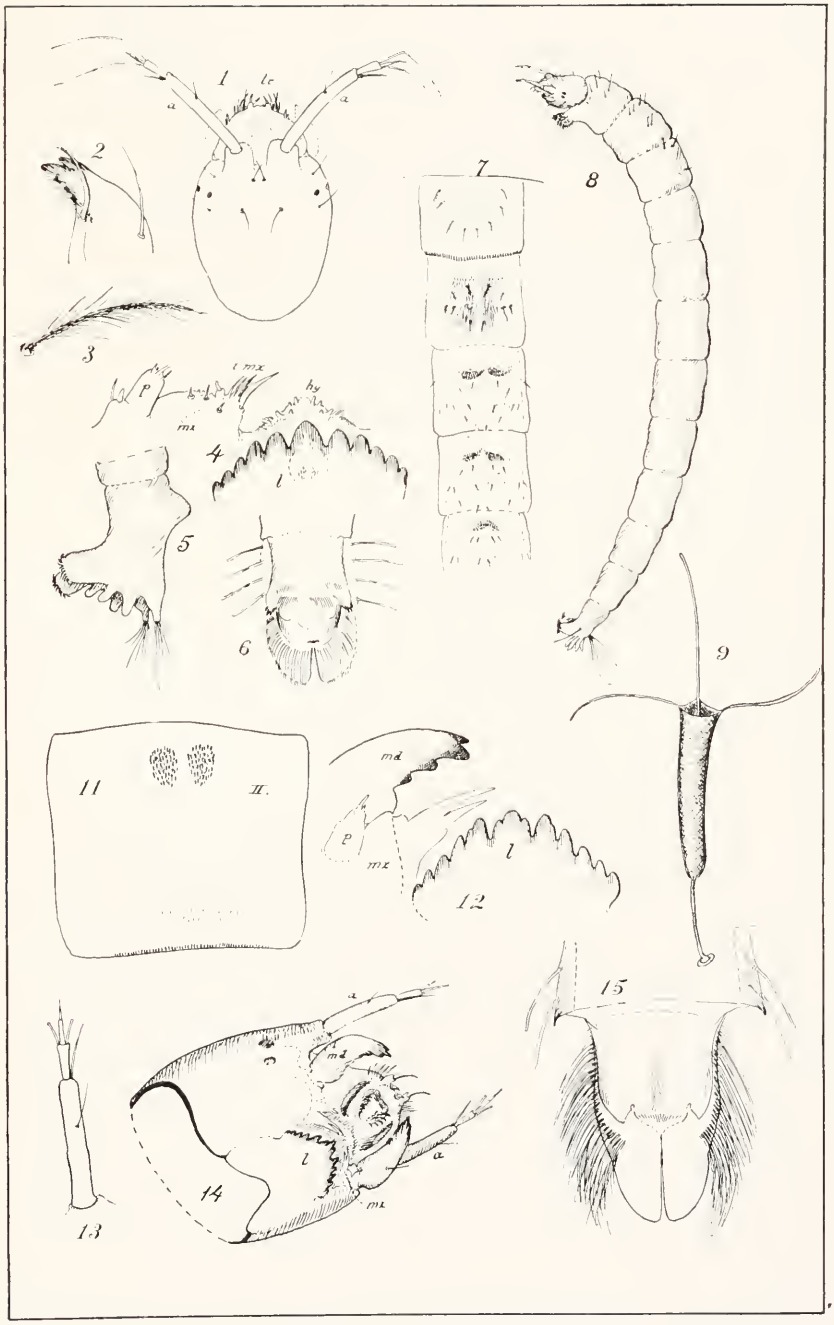
Cricotopus and Orthocladius

Plate 25



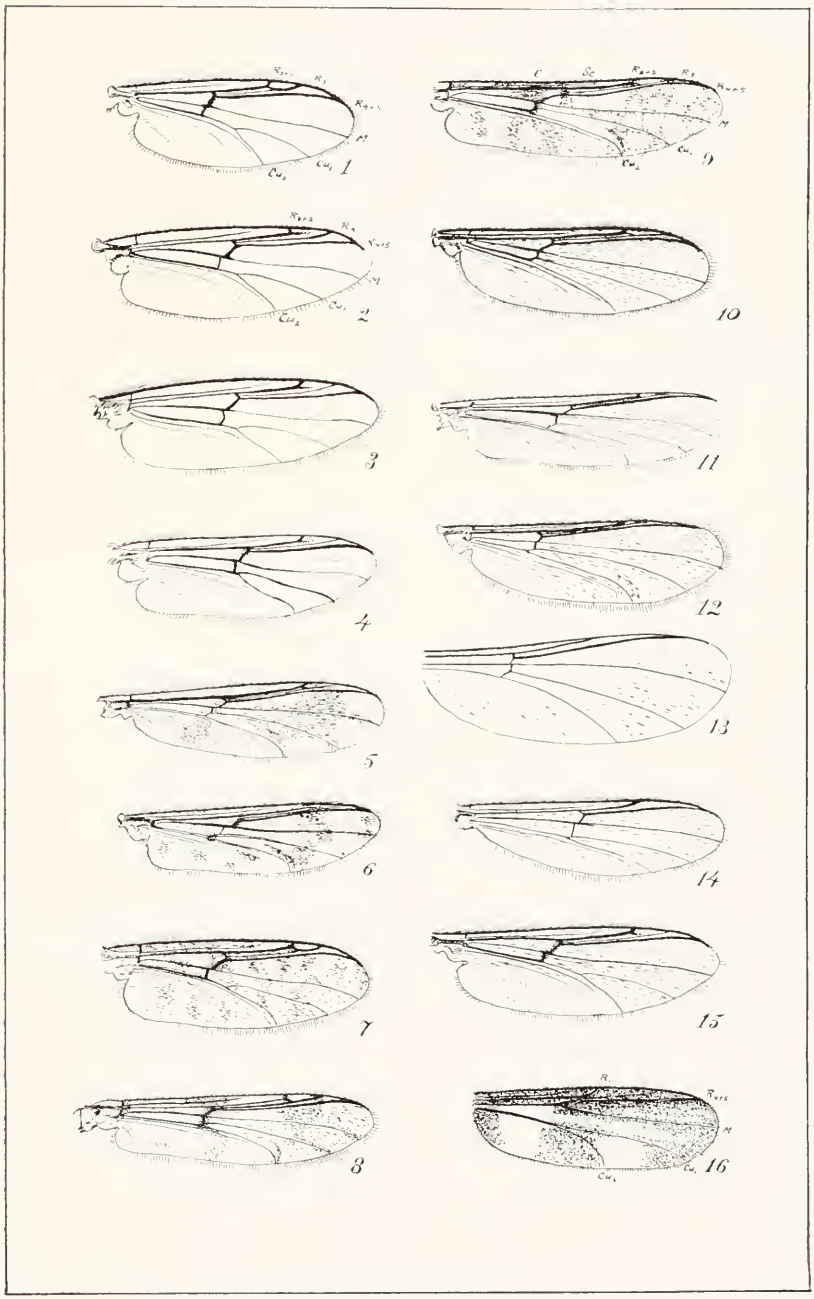
Orthocladius, Tanytarsus, Cricotopus

Plate 26



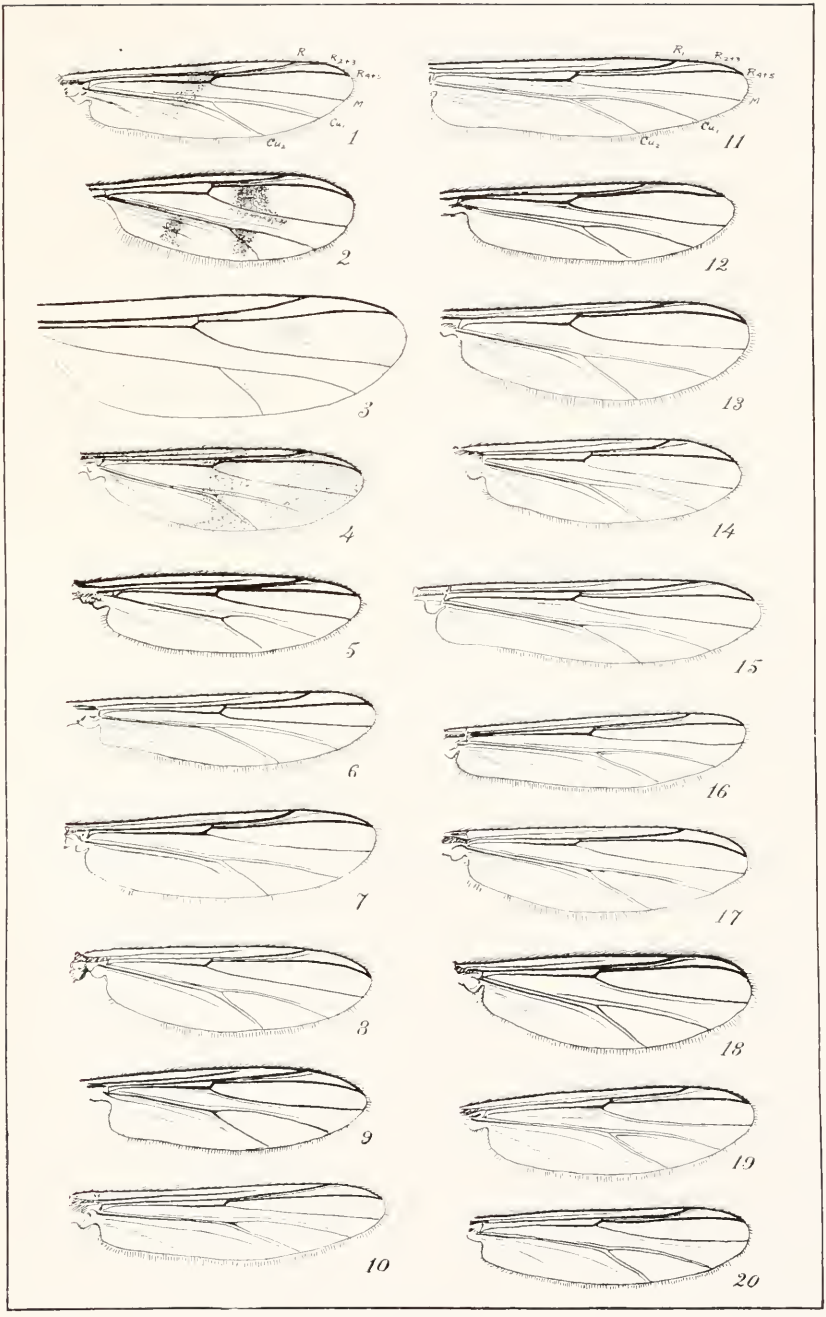
Tanytarsus

Plate 27



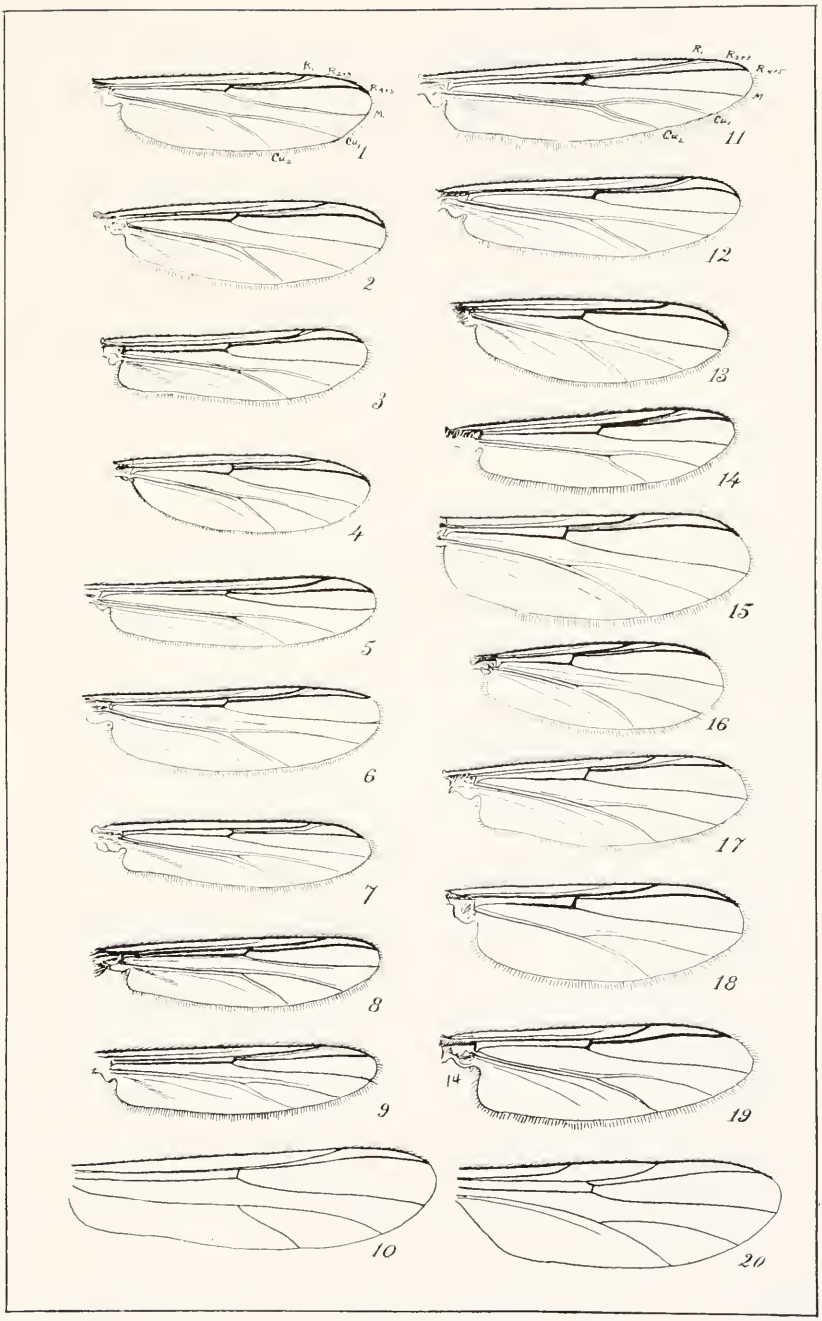
Tanypus group and Chasmatonotus

Plate 28

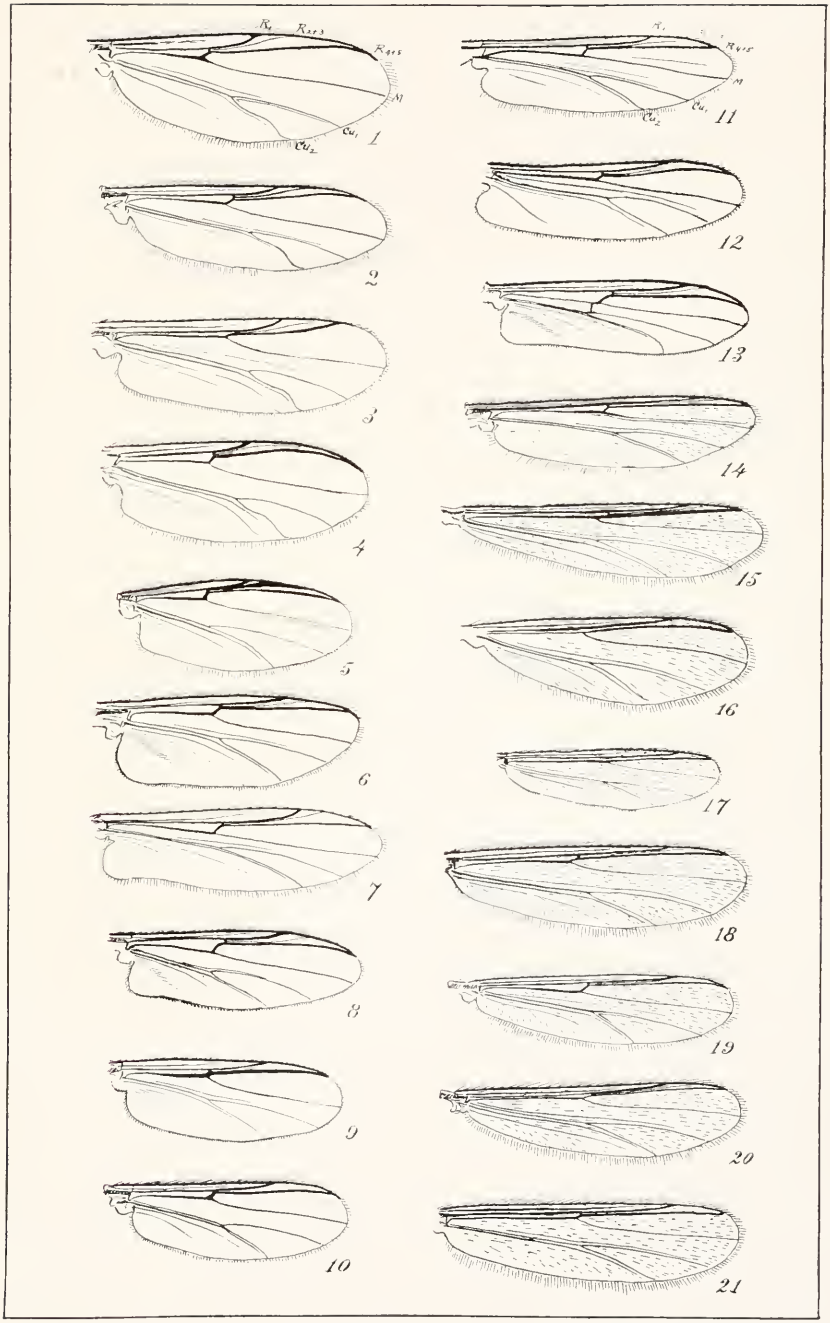


Chironomus

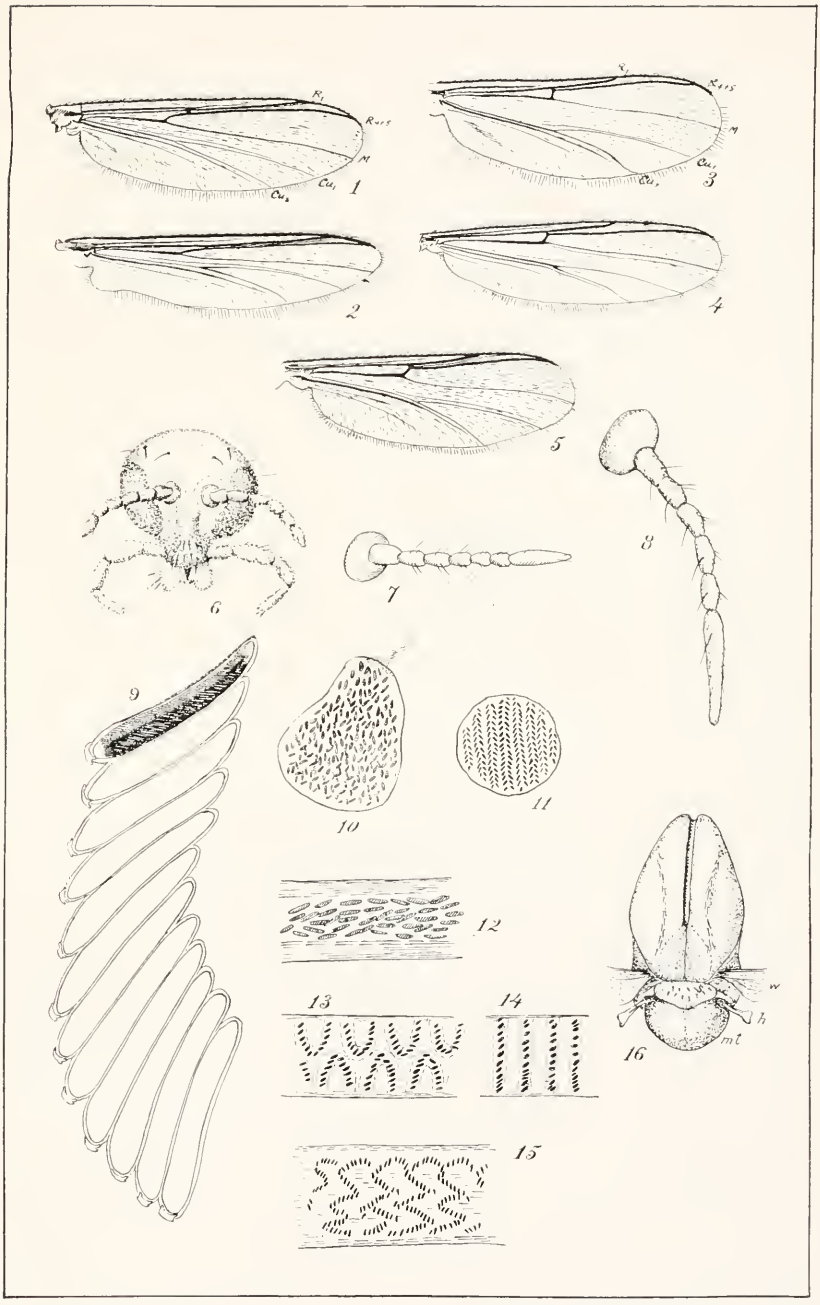
Plate 29



Chironomus (1 to 14). Cricotopus (15-20)

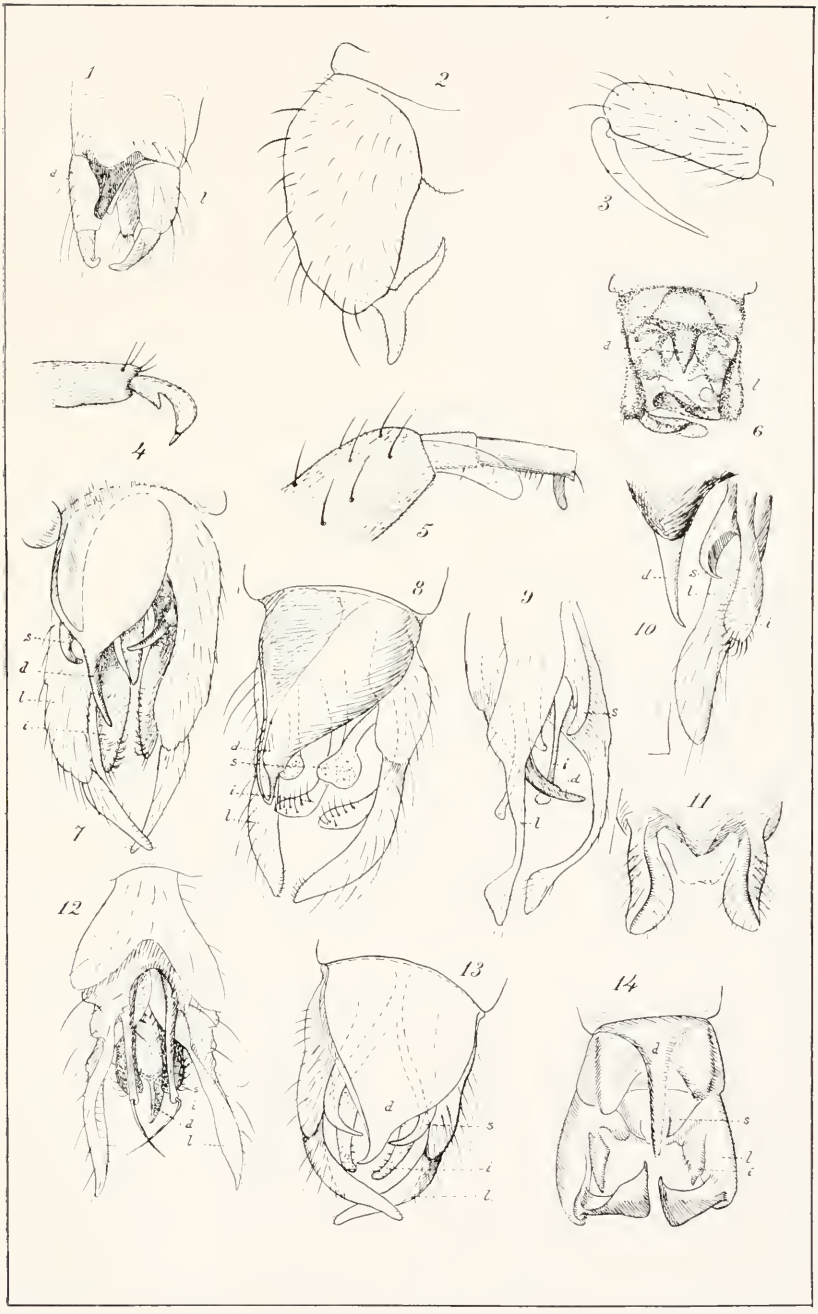


Camptocladius (1 to 4), Orthocladius (5 to 11), Thalassomyia (12), Diamesa (13), Tanytarsus (14 to 21)



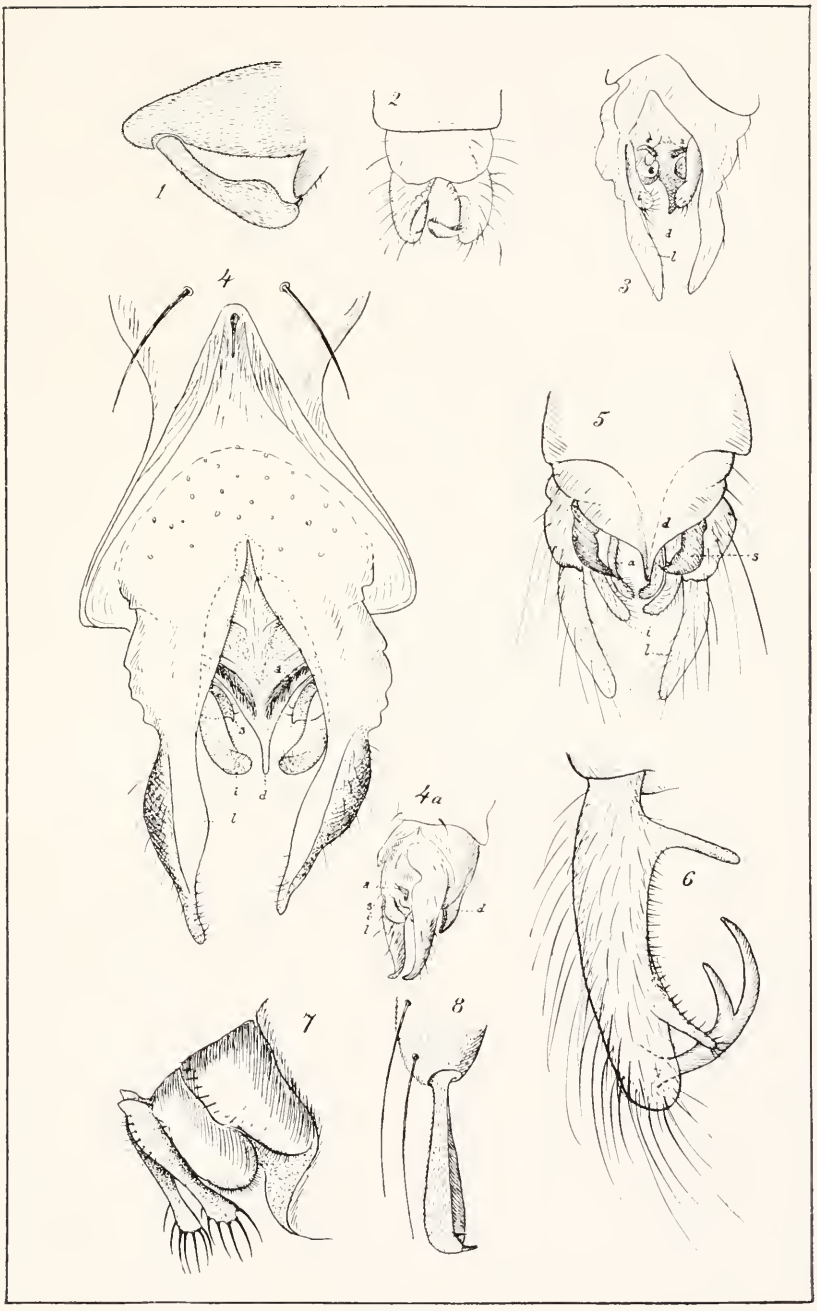
Metriocnemus (1 to 5), Chasmatonotus (6 and 16), Diamesa (7), Orthocladius (8), Eggs and egg masses (9 to 15)

Plate 32



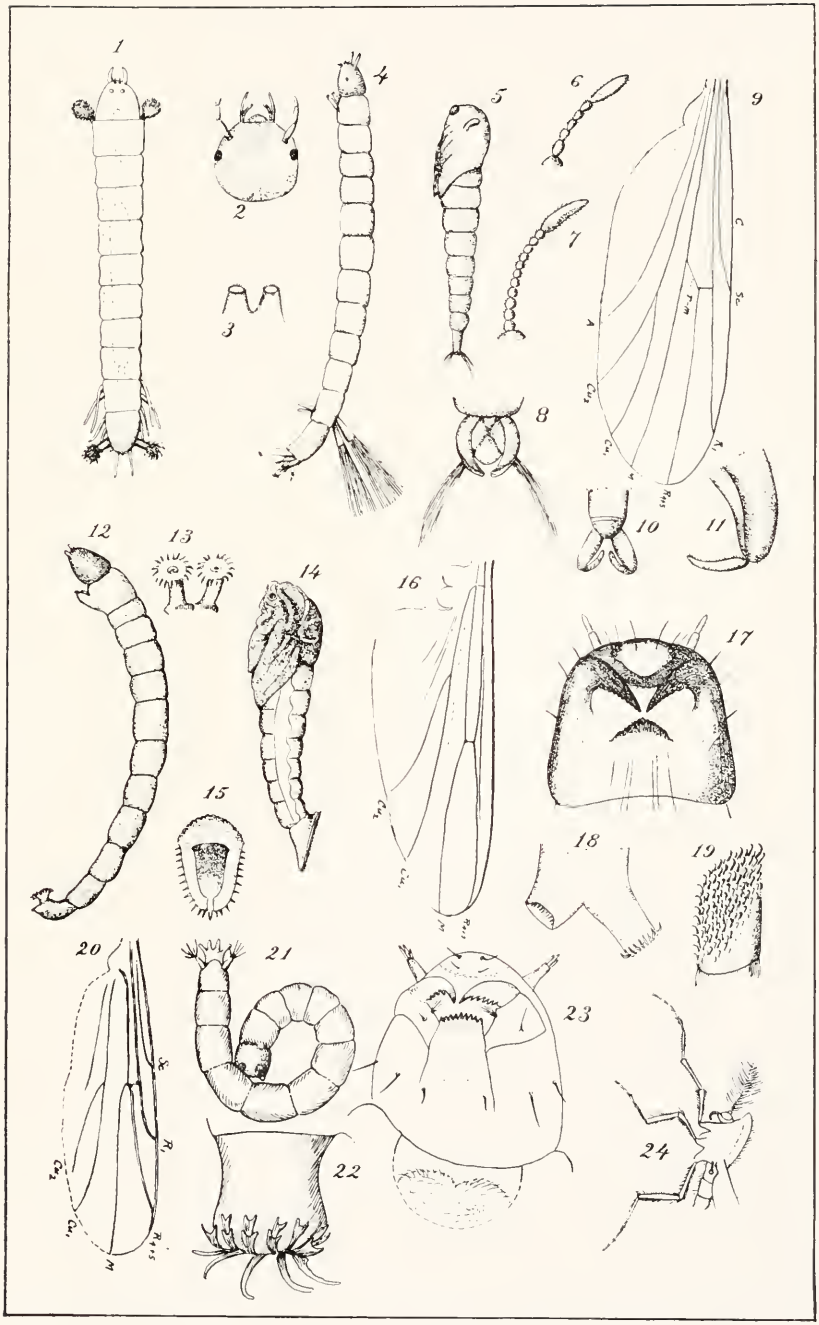
Genitalia

Plate 33



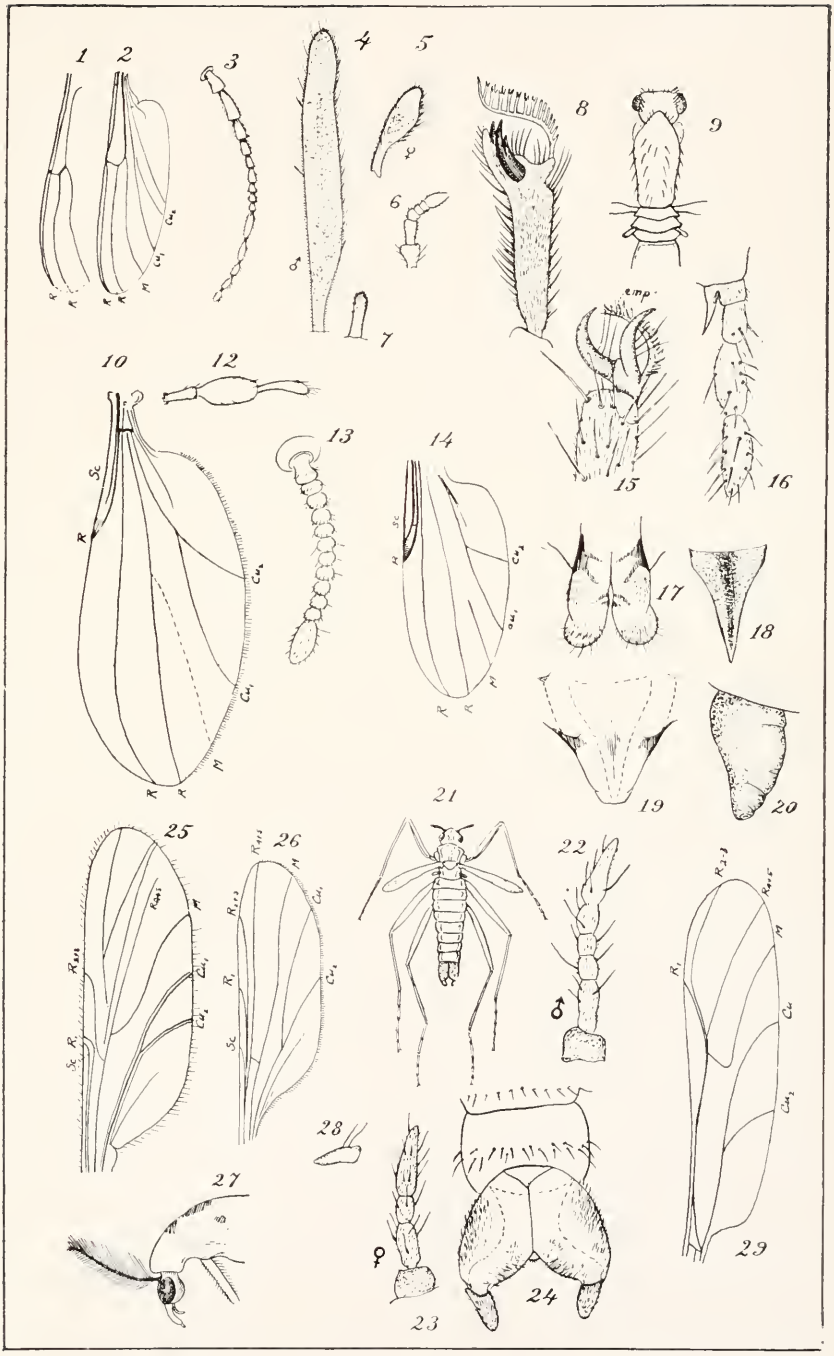
Genitalia

Plate 34



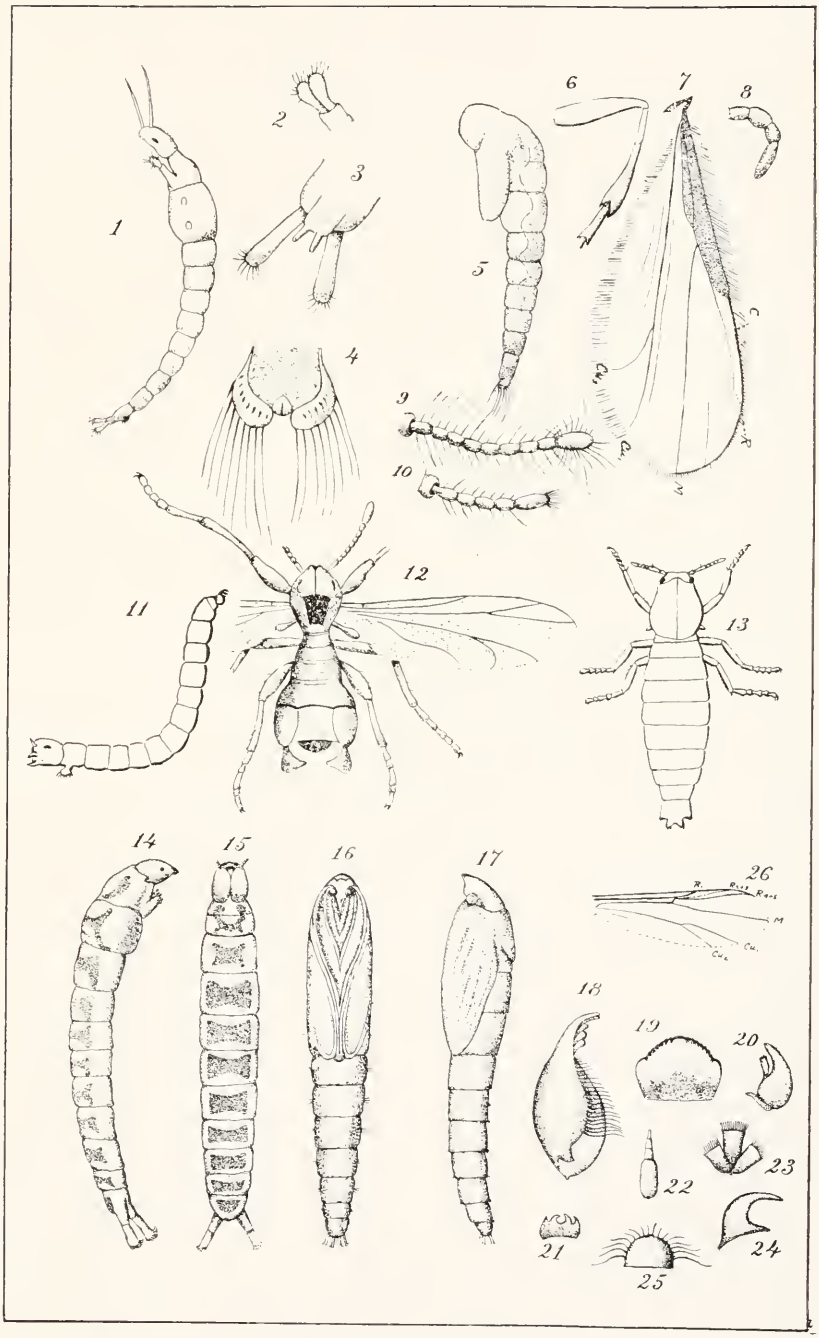
Miscellaneous details

Plate 35



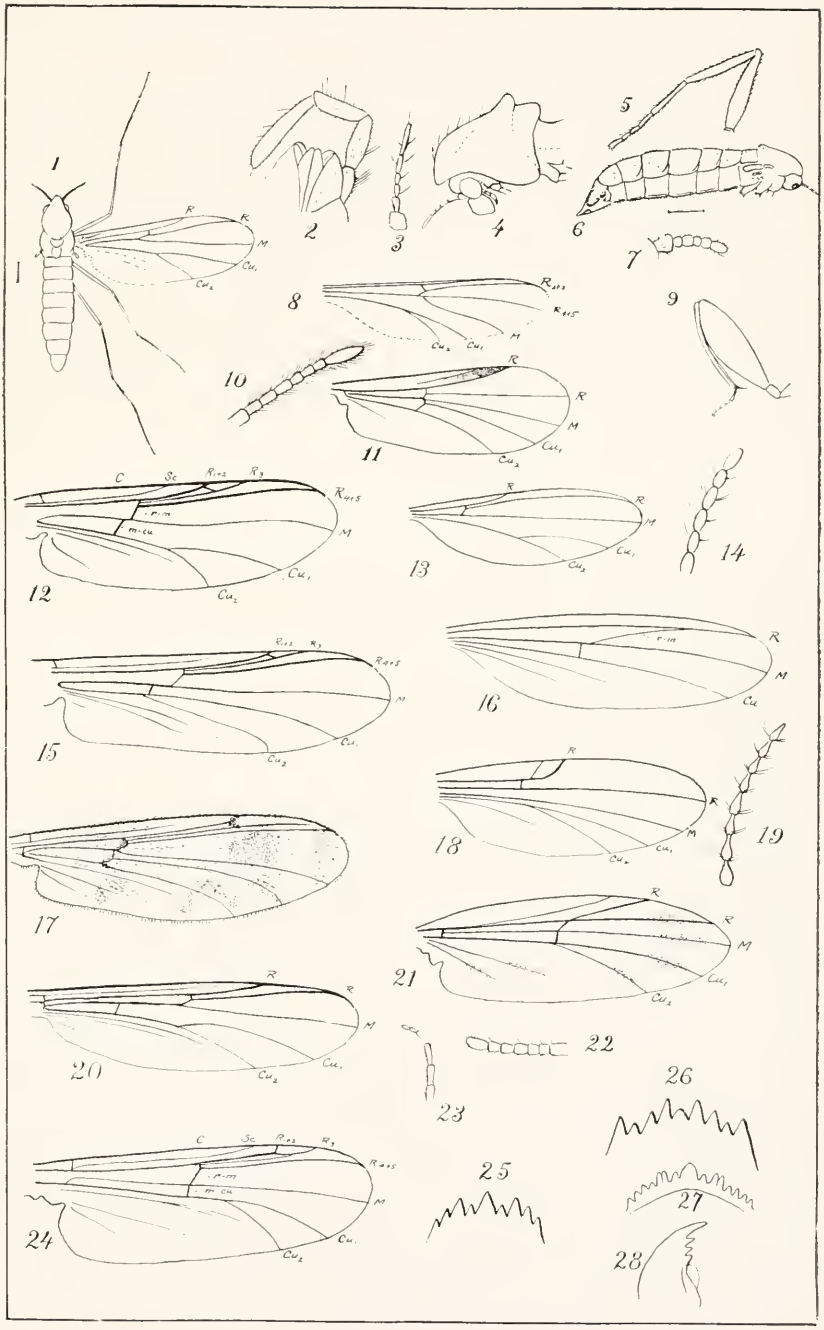
Miscellaneous details

Plate 36



Miscellaneous details

Plate 37



Miscellaneous details

INDEX

The superior figures tell the exact place on the page in ninths; e. g. 136^3 means page 136, beginning in the third ninth of the page, i. e. about one third of the way down. Page numbers referring to descriptions of species are printed in black face type.

abdominalis, Chironomus, 243^4.
aberrans, Chironomus, *see* Chironomus aberrans.
aberrata, Diamesa, *see* Diamesa aberrata.
Ablabesmyia, 89^7, 121^5, 125^7, **135^8–55^7**, 156^5; key to species, 136^1–38^8.
(?) *sp.*, **155^4**; explanation of plate, 320^6.
adumbrata, 155^4.
algens, 137^6, **149^1**.
barberi, 137^6, **146^5**.
bifasciata, 136^9, **139^4**.
carnea, 136^3, 136^8, 137^2, **140^4–42^3**; explanation of plate, 321^3.
var. a, 137^3.
var. c, explanation of plate, 325^4.
discolor, 138^1, **149^3**.
dyari, 136^7, 137^7, **146^9–47^8**; explanation of plates, 320^6, 325^5.
fastuosa, 136^4, 136^8, 138^8, **153^8–54^6**; explanation of plate, 320^9.
flaveola, 138^4, **151^4**, 152^4.
flavifrons, 136^4, 136^7, 138^3, **150^5–51^3**; explanation of plates, 320^4, 325^5.
futilis, 137^1, **139^7–40^4**.
guttularis, 137^6, **145^8–46^5**.
hirtipennis, 138^8, **154^6**.
indecisa, 138^4, **152^1**; explanation of plate, 325^5.
johnsoni, 137^8, **147^9–48^4**.
melanops, 138^2, **149^8–50^4**; explanation of plate, 325^5.
monilis, 122^3, 136^2, 136^3, 137^4, **142^8–44^9**, 153^8, 154^1, 156^9; explanation of plates, 320^6, 320^7, 325^4, 327^5.
nigropunctata, 138^3, 151^3, **155^1**.
Ablabesmyia ornata, 137^8, **148^4**.
pallens, 138^5, **151^6**.
var. a, explanation of plate, 325^3.
pictipennis, 136^9, **138^8–39^4**, 156^2, 156^7.
pilosella, 138^4, 138^6, **152^8–53^3**.
pulchripennis, 137^3, **142^1**; explanation of plate, 330^6.
tibialis, 138^7, **153^3**, 156^4, 156^7.
venusta, 137^5, **145^1**; explanation of plate, 325^5.
absurdus, Orthocladius, *see* Orthocladius absurdus.
Adams, C. F., cited, 310^9.
adumbrata, Ablabesmyia, 155^4.
adumbratus, Procladius, *see* Procladius adumbratus.
Aeschna, 14^6.
sp., 14^7.
Aesculus hippocastanum, 98^7.
aestivus, Chironomus, 299^6.
aestivus, Eurycnemus, 299^2.
Agraylea, 64^6, 64^8, 74^1.
cognatella, 75^3.
multipunctata, 73^3, **74^2–75^5**; explanation of figure, 331^8; figure, 73.
Agrioninae, 14^7.
Alasion, 93^2, 99^4.
rondani, **106^4**.
alaskensis, Telmatogeton, 169^4, **169^5**.
albimanus, Chironomus, *see* Chironomus albimanus.
albipennis, Chironomus, 194^2, **223^4**.
albistria, Chironomus, 198^8, 199^6, **246^6**.
albivitta, Pedicia, 8^3.
albomanicatus, Chirotenetes, *see* Chirotenetes albomanicatus.

albomarginatus, Ceratopogon, 107[3].
albus, Polymitarcys, *see* Polymitarcys albus.
Aldrich, acknowledgments to, 76[8].
algens, Ablabesmyia, 137[9], **149**[1].
allecta, Caenis, *see* Caenis allecta.
Allotrichia, 64[6], 64[9].
alternatus, Siphlurus, 15[2], 18[2], 19[2].
Ameletus, 25[9], 27[8], 30[5].
  ludens, 18[5], **36**[2]–**38**[5]; explanation of plates, 316[9], 317[3]; figures, 36 37; explanation of figure, 331[2].
americana, ? Habrophlebia, 18[3].
americana, Orthotrichia, *see* Orthotrichia americana.
amiculus, Hemerobius, 15[5], 16[1].
amiculus, Palmobius, *see* Palmobius amiculus.
amphibius, Halirytus, 116[8].
Anatopynia, 89[7], 121[9], 125[8], 127[7], 130[8], 131[5], **135**[5].
  consobrinus, 135[7].
  forcipatus, 135[7].
  humeralis, 135[7].
  lactipennis, 135[7].
  morio, 135[7].
  nudipes, 135[7].
  pubitarsis, 135[7].
Anax, 14[6].
  junius, 14[7].
angulatus, Micromus, 15[6].
angustella, Orthotrichia, *see* Orthotrichia angustella.
annularis, Chironomus, *see* Chironomus annularis.
annulatus, Chironomus, 213[1].
annulatus, Tanypus, *see* Tanypus annulatus.
annulipes, Tanypus, 161[8].
anonymus, Chironomus, 190[4], 196[9], **235**[3].
antarctica, Belgica, 113[6].
anticus, Chironomus, 199[7], **247**[7].
Ants, 11.
Apogon, 106[5].
Aquatic Nematocerous Diptera, 76–315.
arcticus, Chironomus, 304[8].
argentata, Ceratopogon (Sphaeromias), *see* Ceratopogon (Sphaeromias) argentata.
argentatus, Sphaeromias, *see* Sphaeromias argentatus.
Argia violacea, 14[6].
Aristotles, cited, 310[9].
Arribalzaga, F. L., cited, 109[5], 109[8], 172[6], 259[4], 310[9].
arundineti, Tipula ?, 149[8].
Asper, cited, 310[9].
aterrimus, Camptocladius, 259[7], **261**[4].
aterrimus, Chironomus, 264[4], 304[9].
Atherix *sp.*, 9[1].
atomarius, Orthocladius, 266[7], **276**[8]–**77**[2].
atra, Corynoneura, **164**[1], 164[5].
atratulus, Metriocnemus, *see* Metriocnemus atratulus.
atricornis, Chironomus *var.*, 218[5].
atrimanus, Chironomus, 190[6], 200[4] **200**[7]–**1**[1].
attenuatus, Chironomus, 198[8], **245**[3].

badius ?, Stratiomyia, 13[9].
Baetinae, 24[8], 27[2], 29[4], 29[5], 29[6].
Baetini, 29[9].
Baetis, 26[2], 27[9], 29[7], 32[3], 38[7].
  pygmaea, 18[1], **40**[4].
Baetisca, 24[3], 27[3], 29[7].
  obesa, 17[9], **30**[4]–**31**[4]; explanation of plate, 316[4]; figure, 30; explanation of figure, 331[2].
Balbiani, cited, 310[9], 311[1].
baltimoreus, Tanypus, 156[8], **160**[5].
Banks, C. S., mentioned, 234[2].
Banks, Nathan, cited, 73[1].
barberi, Ablabesmyia, 137[6], **146**[5].
barbicornis, Orthocladius, 266[6], **283**[3].
barbipes, Chironomus, *see* Chironomus barbipes.
basalis, Choroterpes, *see* Choroterpes basalis.
basalis, Orthocladius, 267[7], **282**[3].
Becker, cited, 311[1].
Bees, 11.
Belgica, 89[3], **112**[8]–**13**[6].
  antarctica, 113[6].
  magellanica, 113[6].

Beling, cited, 8[9].
bellus, Procladius, 126[5], 128[5], **128[7]–29[3]**.
bellus, Tanypus, 128[3].
Bergroth, cited, 311[1].
Berkeley, cited, 311[2].
Berotha, 16[7].
Berry, Edward W., cited, 18[3], 40[9].
Betten, Cornelius, material collected by, 19[6], 63[2].
Beuthin, cited, 162[5], 311[2].
Bezzi, cited, 196[7].
Bezzia, 92[8], 99[4], **102[8]**; explanation of plate, 319[8].
sp., **103[7]–4[4]**; explanation of plate, 319[7].
setulosa, **102[8]–3[7]**, 103[8]; explanation of plates, 319[9], 320[7], 320[8], 327[5].
Bibliography of Chironomidae, 310[8]–15[9].
bicinctus, Cricotopus, *see* Cricotopus bicinctus.
bicolor, Tanypus, 149[9].
bifasciata, Ablabesmyia, 136[9], **139[4]**.
bimacula, Chironomus, 199[8], **247[9]–48[4]**.
bimaculatus, Chasmatonotus, *see* Chasmatonotus bimaculatus.
bipunctata, Forcipomyia, 100[9].
bipunctatus, Ceratopogon, 100[4].
bispina, Ephemerella, *see* Ephemerella bispina.
bivittata, Spaniotoma, 162[8].
Blackwings, 14[6].
Blasturus, 24[9], 27[4], 32[4].
cupidus, 18[3], **40[8]–41[5]**; figure, 41; explanation of figure, 331[3].
Blepharocera, 54[2], 59[4].
Blepharoceridae, 76[2], 79[4].
Blood worms, 79[1], 123[8].
Bohemann, cited, 311[2].
Bolton, mentioned, 69[1].
Bombus consimilis, 13[4].
ternarius, 13[4].
borealis, Chironomus, 198[7], 245[4], **246[3]**.
borealis, Eutanypus, 178[6], **178[9]–79[5]**.
Bouche, cited, 311[2].
brachialis, Chironomus, *see* Chironomus brachialis.
brachiata, Orthotrichia, *see* Orthotrichia brachiata.
Brachypogon, 92[9], 99[4], **104[5]**; explanation of plate, 319[7].
Brauer, F., cited, 311[2].
Bremi, cited, 311[3].
brevipennis, Chironomus, 172[1].
brevipennis, Smittia, 172[1].
brevitibialis, Chironomus, 194[7], **226[9]–27[3]**, 230[5].
Brodie, cited, 77[3].
Brook trout, food of, 7[7].
Brown, J. C., mentioned, 113[9].
browni, Eretmoptera, **114[3]–15[9]**, 118[7].
brunneipennis, Chironomus, 191[4], 191[8], **205[2]**.
brunneus, Chironomus, 198[8], 199[4], **246[9]–47[1]**.
brunnipes, Chironomus, 191[4], 193[1], **204[7]–5[2]**.
Bullfrog, summer food of, at Saranac Inn, by J. G. Needham, 9[7]–15[5].
Bumble bees, worker, 13[4].
Burmeister, cited, 78[2].
Burmeisteria, 91[5], **172[4]**; explanation of plate, 329[8].
photophila, 172[7].
byssinus, Camptocladius, 261[6], 264[7].

Caenini, 29[9].
Caenis, 19[4], 25[4], 27[6], 32[3], 36[2], 38[7].
allecta, 18[3], **47[3]–49[8]**; figures, 48, explanation of figures, 331[4].
diminuta, 18[7], 48[9], 49[6]; explanation of plate, 317[3].
hilaris, 49[3].
hilaris, 47[9], 49[6]; explanation of plate, 317[9], 318[1].
californicus, Chironomus, 192[7], **217[5]**.
caliginosus, Chironomus, *see* Chironomus caliginosus.
caliginosus, Procladius, *see* Procladius caliginosus.
Callibaetis, 26[4], 28[1]; explanation of figure, 331[4]; wings of, figure, 21.
ferruginea, 18[3].
skokiana, 18[3], **40[6]**.
Calopteryx maculata, 14[6].

Cambarus, 13[1].
Camponotus pennsylvanicus, 13[3].
Campsurus, 22[9], 26[6].
Camptocladius, 91[8], 172[3], **259[1]–64[8]**, 265[1], 303[5]; key to species, 259[5]–60[2].
sp., 259[6], **260[9]**; explanation of plate, 326[6].
aterrimus, 259[7], **261[4]**.
bysinnus, 260[1], **262[1]**; explanation of plate, 326[6].
extremus, 260[3], **264[3]**.
fumosus, 259[7], 260[9], **261[1]**; explanation of plate, 326[6].
graminicola, 259[5], **260[3]**, 300[5].
minimus, 259[5], **262[8]–63[3]**; explanation of plate, 326[6].
parvus, 260[2], **263[3]**.
pumilio, 259[9], **261[7]–62[3]**.
velutinus, 260[2], **263[7]–64[3]**.
cantans, Tipula, 218[5].
Carabidae, 11, 13[5].
carnea, Ablabesmyia, *see* Ablabesmyia carnea.
Carpenter, G. H., cited, 120[7], 311[3].
catesbiana, Rana, *see* Rana catesbiana.
Cecidomium grandaevum, 77[3].
celeripes, Corynoneura, *see* Corynoneura celeripes.
Centroptilum, 26[3], 27[9].
Ceratolophus, 93[1], 99[4], 104[8], **104[9]–5[3]**, 106[4].
sp., **105[3]**.
Ceratopogon (group), 76[4], 77[3], 78[8], 87[2], 88[3], 92[5], 94[5], 94[7], **97[1]–121[8]**.
Ceratopogon (genus), 13[9], 78[1], 80[4], 83[1], 83[4], 84[1], 92[6], 92[7], 101[2], 101[7], 102[8], 111[5], 111[7], 112[3], 283[3].
sens. lat., explanation of plates, 319[5], 319[8], 320[1].
sens. str., **99[9]–101[3]**.
sp., **100[2]**.
sp. sens. lat., **110[3]**, **110[5]–11[1]**.
albomarginatus, 107[3].
(Sphaeromyas) argentata, 122[3].
bipunctatus, 100[1].
fasciata, 104[7].
fasciatus, 107[3].
Ceratopogon femoratus, 105[2], 108[4].
flavipes, 106[6].
hortulanus, 106[6].
ornata, 102[7].
punctata, 101[5].
rostratus, 112[7].
vitiosus, 104[5].
Chagnon, cited, 311[3].
Chasmatonotus, 84[3], 90[9], 93[9], **166[3]**, 297[4]; key to species, 166[5].
bimaculatus, 166[5], **166[7]–67[3]**; explanation of plates, 325[6], 327[2], 327[4], 327[6].
maculatus, 167[3].
unimaculatus, 166[7], 167[1], **167[6]**.
univittatus, 166[6], **167[4]**.
Chevrel, cited, 308[5], 311[3].
Child, cited, 311[3].
chiopterus, Chironomus, 276[9].
Chironomidae, 7[8], 13[7], 76–310; bibliography, 310[8]–15[9]; characteristics of egg, larva, pupa and adult, 81[2]–86[9]; economic importance, 78[5]–79[2]; enemies, 79[2]; geological distribution, 77[7]–78[5]; key to genera, 87[1]–94[5]; methods of capturing, rearing and mounting, 79[4]–81[2]; North American, key to genera, 93[5]–94[5].
Chironomus (group), **179[6]–308[9]**.
Chironomus (genus), 13[3], 77[8], 78[1], 78[3], 80[2], 80[9], 83[3], 84[1], 84[9], 85[5], 87[8], 88[4], 91[5], 91[7], 98[3], 121[3], 122[1], 122[9], 123[5], 123[9], 124[1], 127[3], 133[7], 140[4], 142[8], 158[9], 162[7], 164[8], 170[8], 171[9], 172[1], 172[4], 172[9], 173[4], 174[5], **186[4]–250[7]**, 251[2], 252[8], 256[6], 257[8], 258[1], 259[8], 260[3], 261[4], 261[7], 262[4], 262[9], 263[3], 264[8], 265[4], 268[4], 269[1], 272[5], 274[3], 276[5], 276[8], 277[2], 278[3], 278[8], 281[1], 282[9], 283[3], 284[2], 287[7], 288[9], 290[9], 291[5], 296[6], 296[9], 299[1], 299[3], 299[7], 301[6], 302[5], 304[1], 304[4], 304[8], 305[5]; key to species, 188[3]–99[9].
sp., 188[6], 188[7], 188[9], 189[1], 235[1], **248[8]–50[7]**, **309[4]–10[7]**; explanation of plates, 319[4], 322[3], 322[8], 323[3], 327[3], 330[9]; figures, 309.
sens. lat. sp., explanation of plate, 321[4].

Chironomus abdominalis, 243[4].
aberrans, 193[1], **221**[3]; explanation of plate, 325[9].
aestivus, 299[5].
albimanus, 192[4], 205[3], **214**[2]; explanation of plate, 325[9].
albipennis, 194[2], **223**[1].
albistria, 198[8], 199[2], **246**[8].
annularis, 190[4], 192[3], 211[5], **212**[9]–**13**[3], 214[3], 237[2]; explanation of plate, 325[3].
annulatus, 213[1].
anonymus, 190[4], 196[9], **235**[3].
anticus, 199[7], **247**[7].
arcticus, 304[8].
aterrimus, 264[4], 304[9].
var. atricornis, 218[5].
atrimanus, 190[6], 200[1], **200**[7]–**1**[1].
attenuatus, 198[5], **245**[3].
barbipes, 192[2], **212**[2]; explanation of plate, 325[8].
bimacula, 199[6], **247**[9]–**48**[1].
borealis, 198[7], 245[1], **246**[3].
brachialis, 190[6], 192[9], **200**[1], 246[3]; explanation of plate, 325[7].
brevipennis, 172[1].
brevitibialis, 194[7], **226**[9]–**27**[3], 230[5].
brunneipennis, 191[4], 191[8], **205**[2].
brunneus, 198[8], 199[4], **246**[9]–**47**[1].
brunnipes, 191[4], 193[1], **204**[7]–**5**[2].
californicus, 192[7], **217**[5].
caliginosus, 191[5], 193[5], **205**[5]; explanation of plate, 325[7].
chiopterus, 276[6].
chloris, 190[4], 192[5], 193[5], **216**[2].
cingulatus, 240[9].
confinis, 199[9], **248**[2].
crassicollis, 198[5], **245**[3].
cristatus, 197[9], 236[3], 242[3], **242**[4]–**43**[2]; explanation of plate, 326[4].
decorus, 188[5], 189[5], 197[6], 212[1], 233[6], **239**[3]–**40**[8], 248[9], 250[2]; explanation of plates, 323[3], 326[4], 327[7].
devinctus, 192[8], **216**[8]–**17**[4]; explanation of plate, 325[9].
dispar, 192[4], **213**[7].
diversus, 190[3].
Chironomus dizonias, 256[4].
dorsalis, 179[7], 188[8], 197[7], **240**[9]–**41**[8]; explanation of plates, 323[1], 327[3].
dux., 188[6], 190[3], 195[6], **231**[3]; explanation of plate, 326[3].
elegans, 299[5].
fallax, 191[9], **210**[8]–**11**[3], 221[4]; explanation of plate, 325[3].
fascipennis, 191[1], **203**[2], 204[3].
ferrugineovittatus, 197[5], **238**[7]–**39**[2].
festivus, 196[3], **234**[5], 242[4].
fimbriatus, 198[6], 198[8], **245**[8].
flavicingula, 188[5], 189[9], 191[8], **208**[2]–**10**[2], 217[3], 249[5], 249[6]; explanation of plates, 321[5], 325[8], 327[3].
flavus, 189[3], 189[7], 194[9], **225**[2]–**26**[3]; explanation of plates, 322[1], 326[1], 327[7].
frequens, 195[4], **230**[5]; explanation of plate, 326[3].
frigidus, 281[2].
fulviventris, 189[2], 189[8], 195[2], 196[6], 196[8], **229**[3]; explanation of plates, 322[7], 322[9], 326[3], 327[6].
fulvus, 189[5], 194[5], **224**[3]–**25**[2]; explanation of plates, 322[7], 322[8], 326[1].
fumidus, 193[8], **221**[9]–**22**[3]; explanation of plate, 326[1].
glaucurus, 241[9].
grandis, 237[2].
halteralis, 191[8], **210**[2], 222[4]; explanation of plate, 325[5].
hilaris, 199[4], **247**[4].
hirtipes, 299[5].
hyperboreus, 191[6], **206**[8]–**7**[4], 207[6], 245[1], 246[6].
innocuus, 196[9], **235**[8]–**36**[2].
intermedius, 244[4].
jucundus, 195[8], 198[9], **232**[3].
lasiomerus, 199[6].
lasiopus, 199[1], 199[5], **247**[2].
lineatus, 194[1], 196[2], **223**[1].
lineola, 196[2], 223[2], **234**[8].
lobifer, 233[5].
lobiferus, 188[9], 189[9], 195[9], **233**[4]–**34**[5]; explanation of plate, 323[2].
longimanus, 195[9], 196[5], 221[7], **233**[1]; explanation of plate, 326[1].
longipes, 222[5].

Chironomus lugubris, 193[6], **221**[7].
modestus, 188[9], 189[5], 194[8], **227**[4]–**29**[2], 231[4]; explanation of plates, 322[8], 326[3], 327[6], 327[7].
var., 189[6], 194[9].
var., a, 190[2]; explanation of plates, 322[6], 326[2].
var. b, explanation of plates, 322[5], 326[2], 327[6].
nanus, 302[9].
nigricans, 189[3], 190[2], 192[3], 193[3], **219**[5]–**21**[3], 223[9]; explanation of plates, 321[6], 325[9].
nigritibia, 198[6], **246**[1].
nitidellus, 191[9], **210**[6].
niveipennis, 191[6], **205**[9]–**7**[4].
niveipes, 217[3].
nivoriundus, 176[5].
nubeculosus, 190[2].
obscurus, 206[2], 283[4].
oceanicus, 199[3].
octopunctatus, 190[8], **201**[5].
pallens, 212[8], 213[2].
palliatus, 192[8], 193[7], **217**[9]–**18**[3].
pallidus, 195[3], **230**[1]; explanation of plate, 326[3].
pavidus, 282[4].
pedellus, 192[9], 193[3], **218**[3], 219[2], 219[4]; explanation of plate, 325[9].
pedestris, 193[1], **219**[1].
pellucidus, 199[9], **248**[5].
pilicornis, 206[2].
pilipes, 244[5].
plumosus, 188[5], 189[6], 197[4], **236**[9]–**38**[7], 250[2]; explanation of plates, 323[5], 326[4].
polaris, 198[4], 206[9], **244**[8]–**45**[3].
prasinus, 188[8], 198[2], **244**[3]; explanation of plate, 330[8].
pulchripennis, 191[3], 203[5], **204**[4].
redeuns, 197[3], **236**[6].
riparius, 190[4], 192[2], **211**[3]–**12**[2]; explanation of plate, 325[8].
rudis, 206[2].
scalaenus, 190[8], **201**[9]–**2**[6]; explanation of plate, 325[7].
similis, 197[2], 197[8], **236**[2]; explanation of plate, 326[4].
spilopterus, 190[9], **202**[6]–**3**[1]; explanation of plate, 325[7].
Chironomus staegeri, 191[7], **207**[4]–**8**[2], 245[1], 246[6].
stigmaterus, 197[7], **241**[8]–**42**[4].
taeniapennis, 191[2], **203**[5], 204[3], 204[4]; explanation of plate, 325[7].
taenionotus, 194[3], **223**[9]–**24**[2].
tendens, 193[9], 196[4], **222**[5], 230[9], 234[9], 242[4].
tenellus, 188[6], 189[5], 192[5], 193[6], **214**[7]–**16**[1]; explanation of plate, 321[5].
tentans, 188[8], 190[4], 198[1], **243**[3]–**44**[3]; explanation of plate, 330[9].
triannulatus, 258[1].
trichomerus, 199[9], **248**[6].
tricinctus, 253[7].
tristis, 213[2].
unicolor, 199[7].
variabilis, 272[6].
varipennis, 190[7], **201**[1].
venustus, 241[1].
vernalis, 243[4].
vernus, 291[1].
vibratorius, 258[1].
virescens, 190[4].
viridicollis, 195[7], 197[3], **232**[1]; explanation of plate, 326[3].
viridipes, 211[5].
viridis, 195[5], 227[1], **230**[7].
vulneratus, 230[9].
waldheimii, 241[2].
willistoni, 196[7], **235**[1].
zonulus, 211[5].
Chirotenetes, 25[7], 27[7], 28[9], 29[8], 30[7], 32[3], 36[2], 37[2].
albomanicatus, 18[4], 29[1], **31**[5]–**36**[2], 54[4]; explanation of plates, 316[5], 316[6].
ignotus, 28[9].
Chloeon, 26[3].
chloris, Chironomus, *see* Chironomus chloris.
chorea, Diamesa, 174[3], **176**[9]–**77**[4].
choreus, Tanypus, 156[7], **159**[6]–**60**[2].
Choroterpes, 25[2], 27[4], 32[4].
basalis, 18[5], **38**[5]–**40**[4]; explanation of plates, 316[9], 317[2].
Chrysomelidae, 7[7], 13[8].
cinctus, Tanypus, 125[6], 155[9].
cinerea, Molanna, 14[4].
cingulatus, Chironomus, 240[9].

claripennis, Orthocladius, 267[2], **278**[3].
clavata, Ithytrichia, *see* Ithytrichia clavata.
clepsydrus, Orthocladius, 266[5], **283**[8]–**84**[1].
Climacia, 16[6].
  dictyona, 15[5].
Cloeon, 28[2].
Clunio, 89[2], 90[4], **120**[2]–**21**[8].
  marinus, 120[8]; explanation of plate, 329[7].
Cockerell, T. D. A., acknowledgments to, 19[6]; mentioned, 42[9], 46[2], 46[3], 63[4]; cited, 311[4].
coercens, Oxyethira, *see* Oxyethira coercens.
cognatella, Agraylea, 75[2].
Coleoptera, 11, 12[5], 13[5].
collata, Neotrichia, *see* Neotrichia collata.
Coloburus, 25[7], 28[2].
Compontia, 186[4].
  cruciformis, explanation of plate, 328[1].
Comstock, J. H., cited, 31[6], 79[6], 82[2], 86[2], 311[4]; acknowledgments to, 76[7].
concinnus, Procladius, 126[7], **129**[7]–**30**[4].
confinis, Chironomus, 199[9], **248**[2].
confusa, Ithytrichia, *see* Ithytrichia confusa.
congregata, Thalassomyia, *see* Thalassomyia congregata.
consimilis, Bombus, 13[4].
consimilis, Hydroptila, *see* Hydroptila consimilis.
consobrinus, Anatopynia, 135[7].
Coquillett, cited, 82[2], 145[5], 182[9], 257[6], 267[9], 268[4], 284[1], 307[4], 311[5].
Corethrinae, 81[8].
Corethrium pertinax, 77[8].
Corynocera, 90[3], 161[8]–62[5].
  crassipes, 162[4].
Corynoneura, 87[7], 90[6], 90[8], 93[8], 96[1], 116[8], 117[1], **162**[9]–**63**[9].
  sp., explanation of plate, 329[9].
  atra, **164**[1], 164[5].
  celeripes, **164**[3]; explanation of plate, 327[5].
Corynoneura lemnae, 88[6], 163[5]; explanation of plate, 329[5].
  scutellata, 163[9].
Cox, cited, 311[4].
Crane flies, 81[7].
crassicollis, Chironomus, 198[5], **245**[8].
crassinervis, Tanypus, 156[9], **158**[1].
crassipes, Corynocera, 162[4].
Cricotopus, 87[7], 88[9], 91[7], **250**[5]–**58**[9], 259[1], 264[9], 265[1], 265[4], 273[5], 280[6]; key to species, 251[7]–52[5].
  bicinctus, 252[4], **256**[5]; explanation of plate, 326[5].
  debilis, 252[6], **258**[6]; explanation of plate, 326[7].
  exilis, 251[8], 251[9], 252[3], **255**[2]–**56**[8], 256[9], 257[2], 257[4]; explanation of plates, 323[6], 326[6], 327[8].
  geminatus, 252[2], **253**[3].
  sylvestris, 252[5], **257**[8]–**58**[5]; explanation of plate, 326[6].
  tremulus, 252[4], **252**[7]–**53**[3].
  trifasciatus, 251[7], 251[9], 252[5], **253**[7]–**55**[2]; explanation of plates, 323[7], 326[4].
  var. tricinctus, 252[3].
  varipes, 251[8], 251[9], 252[4], **256**[3]–**57**[7]; explanation of plates, 324[8], 326[5].
cristata, Orthotrichia, 73[9], **75**[6].
cristatus, Chironomus, *see* Chironomus cristatus.
cruciformis, Compontia, *see* Compontia cruciformis.
Crustaceans, 11, 13[1].
Culex, 83[4], 124[2].
Culicidae, 76[2].
Culicids, 81[8].
culiciformis, Tanypus, *see* Tanypus culiciformis.
Culicoides, 92[7], 98[9], 99[4], **101**[6], 101[7], 111[5], 111[7], 111[9], 112[5].
  sp., explanation of plate, 320[1].
  murinus, 99[1].
  pulicaris, 101[5].
culicoides, Diamesa, *see* Diamesa culicoides.
cupidus, Blasturus, *see* Blasturus cupidus.
Curculionidae, 13[9].
Curtis, cited, 107[2], 244[9], 246[5], 311[7].

Cyanophyceae, 35[7], 40[5].
Cybister, 34[7].
Cyllene minutissimella, 65[8].
Cynigma, 23[9].

Dahl, cited, 311[7].
Damselflies, 7[6].
Darest, cited, 311[7].
debilipennis, Metriocnemus, 300[6], **302**[5].
debilis, Cricotopus, *see* Cricotopus debilis.
Deby, cited, 118[6], 311[7].
decedens, ?Tanypus, 138[9], 156[9].
decorus, Chironomus, *see* Chironomus decorus.
deflectus, Tanytarsus, *see* Tanytarsus deflectus.
Degeer, cited, 123[3], 311[7].
delineatus, Hydroptila, *see* Hydroptila delineatus.
Derham, cited, 311[8].
devinctus, Chironomus, *see* Chironomus devinctus.
diabolica, Vespa, 13[5].
Diamesa, 88[8], 89[5], 90[2], 90[3], 93[7], 172[1], **172**[8]–**78**[3], 183[3]; key to species, 174[1].
aberrata, 174[4], 174[5], 176[7], 176[9], 177[3].
chorea, 174[3], **176**[9]–**77**[4].
culicoides, 174[2], 175[5], **177**[4]–**78**[3]; explanation of plate, 329[8].
praecox, explanation of plate, 327[5].
waltlii, 88[1], 88[9], 174[1], 174[2], 174[3], **174**[4]–**76**[3], 179[5], 274[4], 276[4]; explanation of plates, 321[3], 326[3], 327[2], 327[7].
dictyona, Climacia, 15[5].
Didymorphleps, 94[6], 99[5], **111**[8]–**12**[8]; explanation of plate, 329[3].
hortorum, 112[6].
difficilis, Orthocladius, 266[9], **277**[2].
Dilar, 16[5].
diminuta, Caenis, *see* Caenis diminuta.
Diptera, 7[7], 11, 12[5], 13[3]–14[1]; aquatic Nematocerous, 76–315.
discolor, Ablabesmyia, 138[1], **149**[3].
dispar, Chironomus, 192[4], **213**[7].
dissimilis, Tanytarsus, *see* Tanytarsus dissimilis.
diversus, Chironomus, 190[8].
dives, Tanytarsus, *see* Tanytarsus dives.
Diving beetle, 34[7].
Dixidae, 76[2].
dizonias, Chironomus, 256[4].
Doloplastus, 91[3], **171**[5]; explanation of plate, 330[4].
dorsalis, Chironomus, *see* Chironomus dorsalis.
Douglass, cited, 282[3].
Dragonflies, 7[6], 14[5].
Drunella, 25[4], 27[6], 42[2], 42[4], **42**[3]–**43**[4].
grandis, explanation of plate, 317[6], 317[7].
dualis, Oxyethira, *see* Oxyethira dualis.
Dufour, cited, 311[8].
Duisberg, cited, 78[2].
dux, Chironomus, *see* Chironomus dux.
Dyar, H. G., cited, 146[9], 190[4], 228[3], 235[3], 311[5].
dyari, Ablabesmyia, *see* Ablabesmyia dyari.

Eaton, cited, 18[1], 18[8], 21[1], 28[2], 28[8], 31[3], 31[7], 37[2], 38[4], 41[6], 42[9], 43[1], 47[1], 50[5], 51[7], 61[2], 63[3], 311[8].
Ecdyurus, 23[9], 26[8], 53[3].
maculipennis, 18[5], 35[9], 38[7], 52[4], 54[3], **57**[1]; explanation of plates, 316[4], 316[9]; figures, 51, 52, 53; explanation of figures, 331[4], 331[5], 331[6], 331[7], 331[8].
Egger, cited, 311[9].
Elateridae, 13[6].
elegans, Chironomus, 299[5].
elegantula, Rhithrogena, *see* Rhithrogena elegantula.
Ellenberger, cited, 311[9].
Empids, 79[4].
Enallagma *sp.*, 14[7].
Enteromorpha, 116[8], 117[5].
Epeorus, 23[8].

Ephemera, 23[4], 26[6]; explanation of figure, 331[1]; venation of fore wing of, figure, 22.
varia, 18[2].
Ephemerella, 25[3], 27[5], **41[5]–42[3]**.
sp.?, 42[7], **46[2]–47[4]**; explanation of plate, 317[7], 317[8].
sp.? near ignita, **45[6]–46[1]**.
bispina, 18[5], 42[5], **43[4]–45[1]**, 45[2], 45[5]; explanation of plate, 317[7], 317[8].
excrucians, 18[2], 41[7], 42[8], 46[3], **47[5]**; explanation of plates, 317[4], 317[7].
grandis, 43[1], 43[3].
ignita, 41[7], 43[6], 45[7].
inermis, 46[3].
unicornis, **45[2]**.
walkeri, 43[6].
Ephemeridae, 11, 12[6], 15[2]; by J. G. Needham, 17[3]–62[9]; life history, 19[1]; structure, 19[7]–22[7]; classification, 28[7]–30[3].
Ephemerinae, 22[8], 26[4], 28[3], 29[5], 59[9]–62[9].
Eretmoptera, 89[3], 93[5], **113[9]–15[9]**; explanation of plate, 329[1].
browni, **114[3]–15[9]**, 118[7].
Erickson, cited, 78[2].
Eristalis, 13[8].
Eurycnemus, 92[2], 199[6], 297[4], **297[9]–98[7]**; key to species, 298[5].
sp., explanation of plate, 328[6].
aestivus, 299[2].
lasiomerus, 298[7], **299[3]**.
scitulus, 298[7], **298[8]**.
unicolor, 298[7], **299[1]**.
Eutanypus, 90[2], 93[3], **178[3]–79[5]**.
borealis, 178[6], **178[9]–79[5]**.
Euthyplocia, 23[3], 26[5].
exagitans, Metriocnemus, *see* Metriocnemus exagitans.
excrucians, Ephemerella, *see* Ephemerella excrucians.
exiguus, Tanytarsus, *see* Tanytarsus exiguus.
exilis, Cricotopus, *see* Cricotopus exilis.
Explanation of plates, 316[1]–30[9].
extremus, Camptocladius, 260[3], **264[3]**.
Fabricius, J. C., cited, 242[8], 311[9]–12[1].
Fabricius, O., cited, 311[9].
fallax, Chironomus, *see* Chironomus fallax.
fasciata, Ceratopogon, 104[7].
fasciata, Heteromyia, 109[4].
fasciatus, Ceratopogon, 107[3].
fasciatus, Tanypus, 159[2], 159[7].
fascipennis, Chironomus, 191[1], **203[2]**, 204[3].
fastuosa, Ablabesmyia, *see* Ablabesmyia fastuosa.
fatigans, Tanytarsus, *see* Tanytarsus fatigans.
femoralis, Hydroptila, 67[3].
femoratus, Ceratopogon, 105[2], 108[4].
femoratus, Melanoplus, 14[9]–15[1].
Ferguson, W. H., work of, 10[4].
ferruginea, Callibaetis, 18[5].
ferrugineovittatus, Chironomus, 197[5], **238[7]–39[2]**.
festivus, Chironomus, 196[3], **234[5]**, 242[4].
Figures, legenda to, 331[1].
fimbriatus, Chironomus, 198[6], 198[8], **245[3]**.
Fitch, cited, 275[5], 312[1].
flavellus, Tanytarsus, *see* Tanytarsus flavellus.
flaveola, Ablabesmyia, 138[4], **151[4]**, 152[4].
flavicinctus, Procladius, 126[9], **132[1]**.
flavicingula, Chironomus, *see* Chironomus flavicingula.
flavifrons, Ablabesmyia, *see* Ablabesmyia flavifrons.
flavifrons, Metriocnemus, *see* Metriocnemus flavifrons.
flavipennis, Heptagenia, 54[7].
flavipes, Ceratopogon, 106[6].
flavus, Chironomus, *see* Chironomus flavus
flavus, Orthocladius, *see* Orthocladius flavus.
Forbes, cited, 79[2], 312[1].
forcipatus, Anatopynia, 135[5].
Forcipomyia, 92[6], **100[8]–1[2]**.
bipunctata, 100[9].
nemoralis, 101[1].
nemorosus, 101[1].

Forcipomyia pictipennis, 100[9].
trichopterus, 100[9], 101[1].
Frauenfeld, cited, 312[2].
frauenfeldi, Thalassomyia, *see* Thalassomyia frauenfeldi.
frequens, Chironomus, *see* Chironomus frequens.
frici, Oxyethira, 71[3].
Fries, cited, 171[3], 312[2].
frigidus, Chironomus, 281[2].
frigidus, Orthocladius, 266[3], 267[5], **268**[4].
fugax, Orthocladius, *see* Orthocladius fugax.
fulvescens, Tanytarsus, *see* Tanytarsus fulvescens.
fulviventris, Chironomus, *see* Chironomus fulviventris.
fulvus, Chironomus, *see* Chironomus fulvus.
fumidus, Chironomus, *see* Chironomus fumidus.
fumosus, Camptocladius, *see* Camptocladius fumosus.
furens, Oecacta, **102**[3].
fusca, Tetraphora, 111[7].
fusca, Thalassomyia, *see* Thalassomyia fusca.
fuscipes, Metriocnemus, 301[2], **305**[5–6][1].
futilis, Ablabesmyia, 137[1], **139**[7–40][4].

Garman, H., cited, 79[1], 239[9], 250[2], 312[2].
Geinitz, cited, 77[3].
geminatus, Cricotopus, 252[2], **253**[3].
Geoffroy, cited, 312[2].
Gercke, cited, 99[1], 312[2].
Gervais, cited, 312[5].
Giard, A., acknowledgments to, 9[1]; cited, 312[3].
Giebel, cited, 78[1].
Gimmerthal, cited, 312[3].
Girault, cited, 312[3].
glaucurus, Chironomus, 241[9].
gmundensis, Tanytarsus, *see* Tanytarsus gmundensis.
Goedart, cited, 312[4].
Goeze, cited, 312[4].
Gomphonema, 35[8].
graminicola, Camptocladius, 259[5], **260**[3], 300[5].
grandaevum, Cecidomium, 77[8].
grandis, Chironomus, 237[2].
grandis, Drunella, *see* Drunella grandis.
grandis, Ephemerella, 43[1], 43[3].
Grasshoppers, 14[9].
grisea, Pentaneura, 161[2].
Grouse locust, 15[1].
Guerin, cited, 312[4].
guttularis, Ablabesmyia, 137[6], **145**[8–46][5].

Habrophlebia, 24[9], 27[4].
americana, 18[3].
Hagen, cited, 65[3], 312[5].
Halesus, 14[4].
Haliday, cited, 173[9], 312[5].
Halirytus, 89[4], **116**[1–17][2]; explanation of plate, 330[2].
amphibius, 116[8].
halteralis, Chironomus, *see* Chironomus halteralis.
hamata, Hydroptila, *see* Hydroptila hamata.
Hammond, cited, 78[6], 84[2], 86[3], 122[2], 124[1], 179[7], 181[1], 241[2], 244[7], 312[5], 313[9].
Hart, C. A., mentioned, 29[8]; cited, 312[5].
Heeger, cited, 173[1], 177[5], 312[5].
Hemerobiidae, 15[6–17][3]; key to genera, 16[4–17][3].
Hemerobius, 17[4].
amiculus, 15[5], 16[4].
occidentalis, 16[3].
tutatrix, explanation of plate, 316[3].
Hemiptera, 11, 12[5], 14[9].
Henshaw, S., cited, 129[3], 129[8], 130[8], 131[5], 132[4], 154[9]; acknowledgments to, 153[2].
Heptagenia, 24[1], 26[7], 32[4].
sp. ?, explanation of plate, 317[5].
sp., no. 3, **56**[2].
flavipennis, 54[7].
interpunctata, 18[6], **54**[5–56][1], 57[1]; explanation of plates, 316[5], 317[5]; figures, 52, 53; explanation of figures, 331[5], 331[6], 331[7].
pulchella, 18[1].

Heptageninae, 23[7], 26[7], 29[5], **51[5]–54[4]**; figure, 52; explanation of figure, 331[5], 331[6], 331[7].
Heptagyia, 90[1], 121[8], 161[5]; explanation of plate, 330[7].
Heteromyia, 93[3], 99[5], **108[6]**; explanation of plate, 330[8].
fasciata, 109[4].
heterostropha, Physa, 12[7].
Hexagenia, 23[5], 26[6].
variabilis, 18[2].
Heyden, cited, 78[4].
hilaris, Caenis, *see* Caenis hilaris.
hilaris, Chironomus, 199[4], **247[4]**.
hippocastanum, Aesculus, 98[7].
hirtipennis, Ablabesmyia, 138[8], **154[6]**.
hirtipes, Chironomus, 299[5].
Holmgren, cited, 264[7], 268[9], 276[7], 282[4], 283[2], 305[3], 312[6].
Homeoneuria, 29[6].
hortorum, Didymorphleps, 112[6].
hortulanus, Ceratopogon, 106[8].
Houghton, C. O., acknowledgments to, 76[5]; cited, 302[4], 313[6].
Howard, W. E., cited, 18[5], 263[3], 312[5]; mentioned, 59[9]; Polymitarcys albus, 60[6]–62[9].
Howdy, white-gloved, 31[5]–36[2].
humeralis, Procladius, 126[7], 130[6].
humeralis, Tanypus, 135[7].
Hydrobaenus, 87[5], 88[6], 91[2], 166[3], **170[5]–71[4]**.
lugubris, 170[9]; explanation of plate, 328[2].
Hydropsyche, 14[4], 32[1], 32[2].
Hydroptila, 63[7], 65[1], 65[4]–69[5], 72[1].
sp., 73[7].
consimilis, 65[6], **65[7]–66[2]**, 66[7]; explanation of plates, 318[4], 319[3].
delineatus, **66[7]**; explanation of plate, 318[4].
femoralis, 67[3].
hamata, **67[1]**; explanation of plate, 318[6].
perdita, **67[4]**; explanation of plate, 319[1].
sparsa, 65[6], 66[1].
spatulata, **66[7]**; explanation of plate, 318[5].
Hydroptilidae, 8[2], 63[1]–72[9], 73[2].
Hydrotrechus, *sp.*?, 14[9].
Hymenoptera, 11, 12[5], 13[2].
hyperboreus, Chironomus, *see* Chironomus hyperboreus.

ignita, Ephemerella, 41[7], 43[6], 45[7].
ignotus, Chirotenetes, 28[9].
Imms, cited, 312[7].
incomptus, Metriocnemus, 300[5], **304[1]**
indecisa, Ablabesmyia, *see* Ablabesmyia indecisa.
inermis, Ephemerella, 46[9].
innocuus, Chironomus, 196[9], **235[8]–36[2]**.
Insecta lapponica, 161[8].
insipidus, Micromus, *see* Micromus insipidus.
intermedius, Chironomus, 244[4].
interpunctata, Heptagenia, *see* Heptagenia interpunctata.
Iron, 23[8], 26[9], 53[3], 54[1].
sp.?, **57[8]–59[2]**; explanation of plate, 317[1]; figures, 52, 53; explanation of figures, 331[5], 331[6], 331[7].
isemerius, Scopelodromus, 308[5].
Isoplastus, 89[5], 121[9], 125[5], 125[7], **155[6]**; explanation of plate, 330[5].
Ithytrichia, 64[9], 67[6]–69[6].
clavata, **67[8]–69[2]**; explanation of plates, 318[7], 319[2].
confusa, **69[2]**; explanation of plate, 318[7].
lamellaris, 68[6].

Jacobs, cited, 312[7].
Jaworowski, cited, 312[7].
Joblot, cited, 312[7].
Johannsen, Oskar Augustus, Aquatic Nematoceras Diptera, 7[8], 76–315; cited, 312[8].
Johnson, cited, 216[1], 218[9], 222[9], 223[4], 228[4], 231[8], 232[7], 232[9], 243[2], 258[5], 262[8], 268[4], 312[8].
johnsoni, Ablabesmyia, 137[8], **147[9]–48[4]**.
Jolia, 28[8].
roeseli, 28[9].
jonas, Micromus, *see* Micromus jonas.

jucundus, Chironomus, 195[5], 198[9], **232**[8].
Juday, Chauncey, acknowledgments to, 19[7]; mentioned, 43[3], 59[3].
Julus, 12[4].
junci, Tanytarsus, 286[3], **290**[9]–**91**[5].
junius, Anax, 14[7].

Kellogg, V. L., acknowledgments to, 76[8]; cited, 78[8], 84[2], 113[7], 114[2], 312[8].
Kennicott, R., mentioned, 238[6].
Kertesz, cited, 312[9].
Kerville, cited, 312[9].
kervilli, Orthocladius. *see* Orthocladius kervilli.
Keys, use of, 19[8]; to species of Ablabesmyia, 136[1]–38[8]; to species of Camptocladius, 259[5]–60[3]; to species of Chasmatonotus, 166[4]; to genera of Chironomidae, 87[1]–94[5]; to species of Chironomus, 188[3]–99[9]; to species of Cricotopus, 251[7]–52[6]; to species of Diamesa, 174[1]; to species of Eurycnemus, 298[5]; to genera of Hemerobiidae, 16[4]–17[3]; to genera of Mayflies of North America, 22[8]–28[2]; to species of Metriocnemus, 300[2]–1[2]; to species of Orthocladius, 265[4]–67[7]; to species of Procladius, 126[2]–27[3]; to species of Tanypus, 156[1]; to species of Tanytarsus, 285[1]–86[7]; to species of Thalassomyia, 183[9].
Kieffer, Abbe J.J., cited, 92[9], 93[9], 94[5], 101[2], 105[2], 106[3], 106[8], 108[7], 120[6], 163[4], 164[5], 258[9], 312[9], 313[1], 313[9].
Kienitz, cited, 313[2].
Kirby, cited, 313[2].
Klapálek, cited, 64[3].
Knab, Fred, mentioned, 307[2].
knabi, Metriocnemus, *see* Metriocnemus knabi.
Kollar, cited, 313[2].
Köllicker, cited, 313[2].
Kupfer, cited, 313[2].

Labidomyia, 100[9], 101[1].
Laboulbene, cited, 313[3].
lactipennis, Anatopynia, 135[7].
lamellaris, Ithytrichia, 68[6].
lapponica, Insecta, 161[9].
lasiomerus, Chironomus, 199[6].
lasiomerus, Eurycnemus, 298[7], **299**[3].
lasiopus, Chironomus, 199[1], 199[5], **247**[2].
Latreille, cited, 313[3].
Lauterborn, R., acknowledgments to, 9[1].
Leger, cited, 313[3].
lemnae, Corynoneura, *see* Corynoneura lemnae.
Lepidoptera, 11, 12[6], 15[2].
Leptoconops, 92[4], 94[3], **94**[7], 96[2]; explanation of plate, 328[9].
Leptophlebia, 24[8], 27[3], 50[5].
praepedita, 18[5], **49**[8]–**51**[5]; explanation of plate, 317[9].
Leptophyes, 49[7].
Lestes, *sp.*, 14[7].
Levi-Morenos, cited, 313[4].
Limnophyes, 90[6], **165**[2]–**66**[2]; explanation of plate, 330[2].
pusillus, 166[2].
lineatus, Chironomus, 194[1], 196[2], **223**[1].
lineola, Chironomus, 196[2], 223[2], **234**[8].
Linne, cited, 313[4].
Lintner, cited, 313[4].
littoralis, Tipula, 218[5].
lobifer, Chironomus, 233[5].
lobiferus, Chironomus, *see* Chironomus lobiferus.
Loew, cited, 78[1], 103[6], 108[3], 313[5].
Long, W. H., cited, 100[8], 313[5].
longimanus, Chironomus, *see* Chironomus longimanus.
longipes, Chironomus, 222[5].
Lowne, cited, 84[6].
lucidus, Polycentropus, 14[4].
ludens, Ameletus, *see* Ameletus ludens.
lugubris, Chironomus, 193[6], **221**[7].
lugubris, Hydrobaenus, *see* Hydrobaenus lugubris.
Lundbeck, cited, 139[1], 153[7], 164[5], 207[3], 207[5], 227[3], 245[1], 246[5], 260[7], 260[8], 262[8], 262[8], 263[7], 264[3], 264[8], 268[9], 276[7], 277[2], 277[6], 278[7], 279[2], 281[6], 291[5], 296[8], 301[5], 302[8], 303[4], 304[8], 305[9], 313[6].
lundbeckii, Metriocnemus, *see* Metriocnemus lundbeckii.
Lyonet, cited, 313[9].

MacGillivray, A. D., acknowledgments to, 76[8]; mentioned, 105[4], cited, 302[4], 313[6].
McLachlan, R., mentioned, 63[4]; cited, 63[8], 64[4], 64[7], 65[3], 69[9], 74[2], 75[2].
Macquart, cited, 313[7].
Macropeza, 77[7], 92[3], **169[8]-70[4]**; explanation of plate, 328[7].
Macroptilum, **308[8]**.
  nudum, 308[9].
maculata, Calopteryx, 14[6].
maculatus, Chasmatonotus, 167[3].
maculatus, Tipula, 142[9].
maculipennis, Ecdyurus, *see* Ecdyurus maculipennis.
magellanica, Belgica, 113[6].
marinus, Clunio, *see* Clunio marinus.
Martin, J. O., mentioned, 47[5].
Mayer, cited, 84[4], 313[7].
Mayflies of North America, key to genera, 22[5]–28[2]. *See also* Ephemeridae.
Megerle, cited, 106[1].
Meigen, cited, 105[9], 106[1], 125[6], 155[7], 306[1], 313[7].
Meinert, cited, 124[5], 313[8].
Melander, A. L., acknowledgments to, 76[8].
Melanoplus femoratus, 14[9]–15[1].
melanops, Ablabesmyia, *see* Ablabesmyia melanops.
Metriocnemus, 87[5], 88[8], 92[2], 93[4], 162[8], 172[3], 260[8], **299[9]-307[3]**; key to species, 300[2]–1[2].
  atratulus, 300[9], **304[4]**; explanation of plates, 327[2], 327[9].
  debilipennis, 300[6], **302[5]**.
  exagitans, 300[7], **303[7]**; explanation of plate, 327[4].
  flavifrons, 300[3], 300[8], **301[5]**; explanation of plate, 327[1].
  fuscipes, 301[2], **305[5]-6[1]**.
  incomptus, 300[8], **304[1]**.
  knabi, 300[9], **306[2]-7[4]**; figures, 306; explanation of figures, 331[9].
  lundbeckii, 300[6], 301[5], **302[9]-3[6]**; explanation of plate, 327[1].
  modestus, 304[4].
  nanus, 300[3], **301[3]**, 303[5].
Metriocnemus par, 300[4], **301[9]-2[4]**; explanation of plates, 327[1], 327[9].
  picipes, 306[3].
  ursinus, 301[2], **304[8]-5[5]**.
Miall, cited, 78[6], 84[2], 86[8], 124[1], 179[7], 181[1], 186[3], 241[2], 313[9].
Micromus, 16[7].
  sp., 15[5].
  angulatus, 15[6].
  insipidus, explanation of plate, 316[3].
  jonas, **15[6]-16[4]**; explanation of plate, 316[3].
Midge, net-winged, 54[2], 59[1].
Mik, cited, 96[1], 98[6], 313[9]-14[1].
Miller, Mrs Mary Rogers, acknowledgments to, 19[7]; mentioned, 49[6].
Millipedes, 11.
minimus, Camptocladius, *see* Camptocladius minimus.
minutissimella, Cyllene, 65[3].
minutus, Orthocladius, *see* Orthocladius minutus.
modestus, Chironomus, *see* Chironomus modestus.
modestus, Metriocnemus, 304[4].
Molanna cinerea, 14[4].
monilis, Ablabesmyia, *see* Ablabesmyia monilis.
monilis, Tanypus, 144[6].
Monnier, cited, 314[1].
morio, Anatopynia, 135[7].
Morley, cited, 314[1].
Morton, Kenneth J., North American Hydroptilidae, 63[1]–72[9].
Mosquitos, 81[7].
Mueller, O. T., cited, 314[2].
multipunctata, Agraylea, *see* Agraylea multipunctata.
murinus, Culicoides, 99[1].
muticus, Tanytarsus, *see* Tanytarsus muticus.

nanus, Chironomus, 302[9].
nanus, Metriocnemus, 300[3], **301[3]**, 303[5].
nebulosus, Tanypus, 139[1].
Needham, James G., bulletin on stoneflies (Perlidae), 8[6]; The Summer Food of the Bullfrog (Rana

catesbiana Shaw) at Saranac Inn, 9[2]–15[5]; Ephemeridae, 17[3]–62[9]; cited, 68[9], 71[6], 78[9], 79[6], 79[8], 86[2], 311[4], 314[2]; mentioned, 74[1], 75[5], 105[4], 107[4], 167[3]; acknowledgments to, 76[8].
nemoralis, Forcipomyia, 101[1].
nemorosus, Forcipomyia, 101[1].
Neotrichia, 65[2], 72[2].
collata, **72**[5]; explanation of plate, 318[9], 319[1].
nervosus, Procladius, *see* Procladius nervosus.
nervosus, Tanypus, 134[1].
Neuronia postica, 14[2].
Neuroptera, 11, 12[6], 15[4].
nigricans, Chironomus, *see* Chironomus nigricans.
nigripilus, Tanytarsus, 285[8], **287**[3].
nigritibia, Chironomus, 198[8], **246**[1].
nigropunctata, Ablabesmyia, 138[3], 151[2], **155**[1].
nitidellus, Chironomus, 191[9], **210**[6].
niveipennis, Chironomus, 191[6], **205**[9]–**7**[4].
niveipes, Chironomus, 217[8].
nivoriundus, Chironomus, 176[5].
nivoriundus, Orthocladius, *see* Orthocladius nivoriundus.
Nowicki, cited, 314[2].
nubeculosus, Chironomus, 190[3].
nudipes, Anatopynia, 135[6].
nudum, Macroptilum, 308[9].

obediens, Tanytarsus, *see* Tanytarsus obediens.
obesa, Baetisca, *see* Baetisca obesa.
obscura, Thalassomyia, 182[9], 183[9], **184**[1]–**85**[8].
obscurus, Chironomus, 206[2], 283[4].
obumbratus, Orthocladius, *see* Orthocladius obumbratus.
occidentalis, Hemerobius, 16[2].
occidentalis, Procladius, 126[4], **127**[8].
occidentalis, Spadobius, *see* Spadobius occidentalis.
oceanicus, Chironomus, 199[3].
oceanicus, Orthocladius, *see* Orthocladius oceanicus.
octopunctatus, Chironomus, 190[8], **201**[5].
Odonata, 11, 12[6], 14[5].
Odonata-Anisoptera, 7[6].
Odonata-Zygoptera, 7[6].
Oecacta, 92[3], 94[2], 99[5], **101**[6]–**2**[2].
furens, **102**[3].
Oligoneuria, 29[3], 29[6].
ornata, Ablabesmyia, 137[8], **148**[4].
ornata, Ceratopogon, 102[7].
Orthocladius, 87[9], 88[9], 91[9], 162[8], 171[5], 172[3], 172[9], 183[4], 183[8], 185[9], 249[4], 251[2], 258[6], 258[9], **264**[8]–**84**[1], 306[6]; key to species, 265[4]–67[7].
absurdus, 267[1], **277**[7]–**78**[2]; explanation of plates, 326[7], 327[2], 327[9].
atomarius, 266[7], **276**[8]–**77**[2].
barbicornis, 266[6], **283**[3].
basalis, 267[7], **282**[3].
claripennis, 267[2], **278**[3].
clepsydrus, 266[5], **283**[8]–**84**[1].
difficilis, 266[9], **277**[2].
flavus, 265[5], 265[7], 266[4], **270**[4]–**72**[1]; explanation of plates, 323[8], 326[7].
frigidus, 266[3], 267[5], **268**[4].
fugax, 257[2], 265[5], 265[8], 267[3], **279**[2]–**80**[9]; explanation of plates, 324[8], 326[7].
kervilli, explanation of plate, 327[8].
minutus, 267[2], 267[3], 278[4], **278**[8]–**79**[2].
nivoriundus, 265[6], 265[7], 266[6], **274**[3]–**76**[4]; explanation of plates, 324[1], 326[7].
obumbratus, 267[6], **281**[6]–**82**[3]; explanation of plate, 326[8].
oceanicus, 266[3], **269**[1]–**70**[4]; explanation of plate, 328[5].
par, 265[9], **267**[7], 302[3].
platypus, 182[9]–83[1], 267[4].
politus, 266[2], **268**[1].
pubitarsis, 267[5], 268[9], **281**[1], 282[2].
sordens, 266[4], **272**[2]; explanation of plate, 326[7].
sordidellus, 265[6], 265[8], 266[4], 266[5], 267[5], **272**[5]–**74**[2], 276[9]; explanation of plates, 324[5], 326[7].
stercorarius, 266[6], 275[5], **276**[4], 300[9], 304[5].
variabilis, 273[7].
Orthoptera, 11, 12[6], 14[9]–15[2].

Orthotrichia, 64[9], 69[6]–70[7].
americana, 73[9], **75**[6]; figure, 73; explanation of figure, 331[5].
angustella, 69[7], **70**[1], **70**[3], **70**[5].
brachiata, **70**[2]; explanation of plate, 318[3].
cristata, 73[9], **75**[6].
tetensii, 69[9], 75[9].
Osborn, cited, 249[2], 314[2].
Osten Sacken, cited, 160[3], 238[6], 244[7], 314[3].
Oxyethira, 64[5], 70[7]–72[1], 72[9].
coercens, **70**[9]–**71**[3]; explanation of plate, 318[3].
dualis, **71**[7]–**72**[1]; explanation of plate, 319[3].
frici, 71[3].
viminalis, **71**[3]; explanation of plate, 318[9].

Pachyleptus, 108[6], 109[4], **110**[1].
Packard, A. S., cited, 110[8], 270[3], 314[3].
pallens, Ablabesmyia, *see* Ablabesmyia pallens.
pallens, Chironomus, 212[8], 213[2].
palliatus, Chironomus, 192[3], 193[7], **217**[9]–**18**[3].
pallidus, Chironomus, *see* Chironomus pallidus.
Palmobius, 17[1].
amiculus, explanation of plate, 316[3].
Palpomyia, 93[1], 93[9], 99[4], 104[8], 105[2], **105**[9]–**6**[4], 106[8].
Panger, cited, 314[4].
par, Metriocnemus, *see* Metriocnemus par.
par, Orthocladius, 265[9], **267**[7], 302[4].
parvus, Camptocladius, 260[2], **263**[3].
pavidus, Chironomus, 282[4].
pectinata, Psamathiomyia, *see* Psamathiomyia pectinata.
pedellus, Chironomus, *see* Chironomus pedellus.
pedestris, Chironomus, 193[1], **219**[1].
Pedicia albivitta, 8[8].
pellucidus, Chironomus, 199[9], **248**[5].
pennsylvanicus, Camponotus, 13[3].
Pentagenia, 26[6].
Pentaneura, 89[7], 121[9], **160**[3]–**61**[2]; explanation of plate, 330[5].
grisea, 161[2].
perdita, Hydroptila, *see* Hydroptila perdita.
Perlidae, 8[6].
Perris, cited, 314[4].
pertinax, Corethrium, 77[8].
Pettit, cited, 314[4].
Philippi, cited, 314[5].
photophila, Burmeisteria, 172[7].
Physa heterostropha, 12[7].
picipes, Metriocnemus, 306[1].
pictipennis, Ablabesmyia, *see* Ablabesmyia pictipennis.
pictipennis, Forcipomyia, 100[9].
pictipennis, Psychophaena, 111[5].
pilicornis, Chironomus, 206[2].
pilipes, Chironomus, 244[5].
pilosella, Ablabesmyia, 138[4], 138[8], **152**[8]–**53**[3].
pinguis, Procladius, *see* Procladius pinguis.
Plant-beetles, aquatic, 7[7].
Plates, explanation of, 316[1]–30[9].
platypus, Orthocladius, 182[9]–83[1], 267[4].
platypus, Thalassomyia, 183[9], **185**[3]–**86**[1].
plumipes, Tanypus, 135[6].
plumosus, Chironomus, *see* Chironomus plumosus.
Podonomus, 89[9], 121[9], **161**[2]; explanation of plate, 330[4].
stigmaticus, 161[4].
Poey, cited, 314[5].
polaris, Chironomus, 198[4], 206[9], **244**[8]–**45**[3].
politus, Orthocladius, 266[2], **268**[1].
Polycentropus lucidus, 14[4].
Polymitarcys, 23[1], 26[5].
albus, 18[6], 59[9], **60**[2]–**62**[9]; explanation of plate, 318[2].
virgo, 29[2], 60[4].
Polystoechotes, 16[6].
postica, Neuronia, 14[2].
posticalis, Tanypus, *see* Tanypus posticalis.
Potamanthus, 23[6], 26[6].
praecox, Diamesa, *see* Diamesa praecox.

praepedita, Leptophlebia, *see* Leptophlebia praepedita.
prasinus, Chironomus, *see* Chironomus prasinus.
Prionomyia, 108[3], 108[4].
priscus, Rhyphus, 77[9].
Procladius, 89[7], 121[9], 125[5], 125[7], **125[8]–27[3]**; key to species, 126[2]–27[3]; explanation of plate, 330[4].
adumbratus, 126[2], 127[1], **132[5]–33[3]**, 136[3], 136[5]; explanation of plates, 320[7], 321[1].
bellus, 126[5], 128[5], **128[7]–29[3]**.
caliginosus, 126[9], 131[5]; explanation of plate, 325[4].
concinnus, 126[7], **129[8]–30[2]**.
flavicinctus, 126[9], **132[1]**.
humeralis, 126[7], **130[2]**.
nervosus, 158[6], 158[8], 160[2]; explanation of plate, 330[6].
occidentalis, 126[4], **127[3]**.
pinguis, 126[2], 127[2], 131[6], **133[3]–34[5]**, 136[9]; explanation of plates, 320[5], 325[4].
pusillus, 126[5], **128[1]**; explanation of plate, 325[4].
scapularis, 127[2], 134[5]–35[4]; explanation of plate, 325[4].
thoracicus, 126[6], **129[3]**.
tricolor, 126[8], **130[9]–31[5]**.
turpis, 126[4]. *See also* Tanypus (Procladius) turpis.
Prodromus, 106[5].
Prosopistoma, 29[7].
Psamathiomyia, 87[2], 89[4], 113[7], **117[3]–20[1]**.
pectinata, 117[4]; explanation of plate, 328[8].
Psychophaena, 94[6], 99[5], **111[2]**.
pictipennis, 111[5].
pubitarsis, Orthocladius, *see* Orthocladius pubitarsus.
pubitarsus, Tanypus, 135[7].
pulchella, Heptagenia, 18[1].
pulchripennis, Ablabesmyia, *see* Ablabesmyia pulchripennis.
pulchripennis, Chironomus, 191[3], 203[5], **204[1]**.
pulicaris, Culicoides, 101[5].
pumilio, Camptocladius, 259[9], **261[7]–62[3]**.
punctata, Ceratopogon, 101[5].
punctipennis, Tanypus, 125[6], 155[9].
Punkies, 77[4].
pusillus, Limnophyes, 166[2].
pusillus, Procladius, *see* Procladius pusillus.
pusio, Tanytarsus, 286[3], **291[5]**.
pygmaea, Baetis, 18[1], **40[1]**.

Rana catesbiana, 8[5]; summer food of, at Saranac Inn, by J. G. Needham, 9[2]–15[5]; explanation of plate, 316[1].
Reaumur, cited, 238[5], 314[5].
redeuns, Chironomus, 197[3], **236[6]**.
Rhithrogena, 24[1], 27[2], 53[3], 53[7], 54[1].
elegantula, **59[2]**; explanation of plate, 317[1]; figures, 52, 53; explanation of figures, 331[5], 331[6], 331[7], 331[8].
Rhyphus priscus, 77[9].
Richardson, R. E., mentioned, 309[1].
Ridley, cited, 314[5].
Riley, C. V., acknowledgments to, 76[5]; cited, 238[6], 314[5].
riparius, Chironomus, *see* Chironomus riparius.
Ris, cited, 64[3].
roeseli, Jolia, **28[9]**.
Rondani, cited, 314[5].
rondani, Alasion, **106[4]**.
rostratus, Ceratopogon, 112[7].
rudis, Chironomus, 206[2].

St Pauli, Telmatogeton, *see* Telmatogeton St Pauli.
Sandflies, 77[4].
Say, cited, 109[5], 109[8], 144[7], 224[3], 228[4], 253[6], 314[6].
scalaenus, Chironomus, *see* Chironomus scalaenus.
scapularis, Procladius, *see* Procladius scapularis.
Scarabaeidae, 13[6].
Schiner, cited, 160[3], 162[4], 168[2], 211[9], 214[3], 238[5], 253[3], 283[7], 296[8], 304[7], 305[9], 314[7].
Scholtz, cited, 314[7].

Schrank, cited, 314[7].
Schubaert, cited, 314[8].
scirpi, Wulpiella, *see* Wulpiella scirpi.
scitulus, Eurycnemus, 298[7], 298[8].
Scopelodromus, 91[6], 307[4–8[7].
  isemerius, 308[5].
Scudder, cited, 78[5], 314[8].
scutellata, Corynoneura, 163[9].
Sendelia, 78[2].
Serromyia, 93[3], 99[6], 106[7], 108[3].
setulosa, Bezzia, *see* Bezzia setulosa.
Sialididae, American, 7[7].
Silfvenius, A. J., cited, 74[2].
similis, Chironomus, *see* Chironomus similis.
Simuliidae, 76[2].
Simulium, 32[2].
Siphlurus, 25[8], 27[8]; figure, 20; explanation of figure, 331[1].
  alternatus, 15[2], 18[2], 19[2].
Sisyra, 16[6].
  umbrata, 15[4].
skokiana, Callibaetis, 18[3], 40[6].
Skuse, cited, 106[2], 108[3], 125[5], 125[7], 135[9], 155[9], 314[8].
Slater, cited, 314[8].
Slosson, cited, 245[6], 314[9].
Smith, cited, 314[9].
Smittia, 91[4], 171[7–72[3].
  brevipennis, 172[1].
Snails, 11.
sordens, Orthocladius, *see* Orthocladius sordens.
sordidellus, Orthocladius, *see* Orthocladius sordidellus.
Spadobius, 16[9].
  occidentalis, explanation of plate, 316[2].
Spaniotoma, 90[5], 162[5]; explanation of plate, 330[5].
  bivittata, 162[8].
sparsa, Hydroptila, 65[6], 66[1].
spatulata, Hydroptila, *see* Hydroptila spatulata.
Sphaeromas, 93[2], 99[5], 107[1]; explanation of plate, 319[8].
  argentata, *see* Ceratopogon (Sphaeromas) argentata.
  argentatus, 107[4–8[3]; explanation of plates, 320[3], 327[3].
Spiders, 11.
spilopterus, Chironomus *see* Chironomus spilopterus.
Stactobia, 65[1].
Staeger, cited, 139[1], 153[7], 207[3], 261[7], 262[8], 268[9], 283[2], 306[1], 314[9].
staegeri, Chironomus, *see* Chironomus staegeri.
stellatus, Tanypus, *see* Tanypus stellatus.
Stenoxenidae, 81[9].
Stenoxenus, explanation of plate, 329[4].
Stephens, cited, 105[9], 314[9].
stercorarius, Orthocladius, *see* Orthocladius stercorarius.
stigmaterus, Chironomus, 197[7], 241[7–42[4].
stigmaticus, Podonomus, 161[4].
Stoneflies, 8[6].
Stratiomyia badius?, 13[9].
Stratiomyidae, 13[7].
Swainson, cited, 186[2], 315[1].
sylvaticus, Tanypus, 159[8].
sylvaticus, Tanytarsus, 287[3].
sylvestris, Cricotopus, *see* Cricotopus sylvestris.
Syrphidae, 13[7].

Tabanidae, 13[7].
Tachinidae, 13[7].
taeniapennis, Chironomus, *see* Chironomus taeniapennis.
taenionotus, Chironomus, 194[3], 223[9–24[2].
Tanypus (group), 121[9–79[6], 87[3], 88[3], 89[6], 93[6].
Tanypus (genus), 78[1], 80[4], 83[3], 83[4], 89[8], 121[9], 140[4], 142[3], 142[8], 149[1], 149[3], 149[8], 151[4], 151[6], 153[3], 155[8–60[3], 178[4], 306[9]; key to species, 156[4].
  sens. str., 125[5].
  sp., 110[9]; explanation of plate, 327[3].
  annulatus, 142[9], 144[6], 144[7], 156[9].
  annulipes, 161[8].
  baltimoreus, 156[8], 160[5].
  bellus, 128[3].

Tanypus bicolor, 149[9].
choreus, 156[7], **159[6]–60[2]**.
cinctus, 125[6], 155[9].
crassinervis, 156[6], **158[4]**.
culiciformis, 156[4], 156[7], **158[9]–59[6]**, 160[7]; explanation of plates, 325[6], 327[5].
decedens, 138[9], 156[9].
fasciatus, 159[2], 159[7].
monilis, 144[8].
nebulosus, 139[1].
nervosus, 134[1].
plumipes, 135[6].
posticalis, 156[6], **157[9]–58[3]**; explanation of plate, 330[7].
punctipennis, 125[6], 155[9].
stellatus, 156[3], **157[1]**; explanation of plate, 325[5].
sylvaticus, 159[8].
tenuis, 159[2].
tibialis, 156[8], **160[3]**.
tricolor, 135[7].
(Procladius?) turpis, **127[3]**, 135[7].
varius, 124[4].
Tanytarsus, 87[7], 88[5], 91[9], **284[2]–97[8]**; key to species, 285[1]–86[7].
sp., 286[2], **290[1]**, **297[3]**; explanation of plates, 322[5], 322[6].
deflectus, 285[9], 286[2], **288[1]**; explanation of plates, 322[2], 326[8].
dissimilis, 285[3], 285[6], 286[4], 286[6], **292[4]–93[3]**; explanation of plates, 324[6], 327[3].
var. a, 285[6].
dives, 285[2], 285[5], 286[2], **288[5]–90[4]**; explanation of plates, 324[9]–25[1], 326[9], 327[9].
exiguus, 226[8], 285[3], 285[4], 286[7], 293[2], 293[5], **294[7]–96[5]**; explanation of plates, 325[2], 327[9].
fatigans, 286[4], **292[1]**; explanation of plate, 326[9].
flavellus, 286[7], **296[9]–97[8]**; explanation of plate, 326[9].
fulvescens, 286[5], **293[9]–94[3]**; explanation of plate, 326[9].
gmundensis, 285[2], 285[9], **287[7]**; explanation of plate, 326[3].
Tanytarsus junci, 286[3], **290[9]–91[5]**.
muticus, 286[6], **294[4]**; explanation of plate, 326[9].
nigripilus, 285[8], **287[3]**.
obediens, 285[8], 286[8]–87[3]; explanation of plate, 326[8].
pusio, 286[3], **291[5]**.
sylvaticus, 287[3].
tenuis, 286[6], **296[6]**.
Taylor, cited, 273[5], 315[1].
Telmatogeton, 88[7], 90[9], 93[4], 94[1], **168[1]–69[1]**.
alaskensis, 169[1], **169[2]**.
St Pauli, 168[3], 168[9]; explanation of plate, 328[3].
tendens, Chironomus, *see* Chironomus tendens.
tenellus, Chironomus, *see* Chironomus tenellus.
tentans, Chironomus, *see* Chironomus tentans.
tenuis, Tanypus, 159[2].
tenuis, Tanytarsus, 286[6], **296[6]**.
ternarius, Bombus, 13[4].
Ternipus, 160[5].
Tersesthes, 92[4], 94[3], **95[1]–96[4]**.
torrens, **96[4]**; explanation of plate, 328[9].
tetensii, Orthotrichia, 69[9], 75[9].
Tetragoneuria, 12[6], 14[8].
Tetraphora, 94[9], 99[5], **111[5]**; explanation of plate, 330[6].
fusca, 111[7].
Text figures, legenda to, 331[1].
Thalassomyia, 88[3], 91[6], **182[8]–86[4]**, 307[8]; key to species, 183[9].
congregata, 88[9], 182[9], 183[1], 308[5].
frauenfeldi, 182[9], **186[2]**, 308[6]; explanation of plate, 328[1].
fusca, 88[2], 174[5], 225[3], 271[3], 308[5]; explanation of plate, 326[5].
obscura, 182[9], 183[9], **184[1]–85[8]**.
platypus, 183[9], **185[8]–86[1]**.
Theobald, cited, 186[4], 315[2].
thoracicus, Procladius, 126[6], **129[3]**.
tibialis, Ablabesmyia, *see* Ablabesmyia tibialis.
tibialis, Tanypus, 156[8], **160[3]**.

Tipula, 142[5], 158[9], 201[9], 212[5], 218[4], 222[5], 252[8], 257[8], 262[4], 276[4], 283[6].
arundineti, 149[5].
cantans, 218[5].
littoralis, 218[5].
maculatus, 142[3].
? virens, 230[5].
Tipulid larva, 8[5].
Tipulidae, 13[7].
Tipulids, 81[7].
Tömösvary, cited, 182[9], 315[2].
torrens, Tersesthes, *see* Tersesthes torrens.
Tortricids, 178[1].
Townsend, cited, 101[9], 102[4], 315[7].
Treat, cited, 315[2].
tremulus, Cricotopus, 252[2], **252**[7]–**53**[3].
triannulatus, Chironomus, 258[1].
trichomerus, Chironomus, 199[5], **248**[6].
Trichoptera, 8[3], 11, 12[5], 14[2].
trichopterus, Forcipomyia, 100[4], 101[1].
tricinctus, Chironomus, 253[7].
tricolor, Procladius, 126[8], **130**[9]–**31**[3].
tricolor, Tanypus, 135[7].
Tricorythus, 49[7].
trifasciatus, Cricotopus, *see* Cricotopus trifasciatus.
tristis, Chironomus, 213[2].
Tubipex, 123[9].
turpis, Procladius, 126[4].
turpis, Tanypus (Procladius), **127**[3], 135[7].
tutatrix, Hemerobius, *see* Hemerobius tutatrix.

Ulmer, cited, 69[2], 295[1], 315[3].
umbrata, Sisyra, 15[4].
unicolor, Chironomus, 199[7].
unicolor, Eurycnemus, 298[7], **299**[1].
unicornis, Ephemerella, **45**[2].
unimaculatus, Chasmatonotus, 166[7], **167**[3], **167**[6].
univittatus, Chasmatonotus, 166[6], **167**[4].
ursinus, Metriocnemus, 301[2], **304**[8]–5[7].

Van der Wulp, cited, 140[4], 170[4], 182[7], 187[2], 212[1], 216[6], 216[7], 218[9], 227[3], 232[7], 244[2], 244[6], 255[2], 256[6], 261[7], 262[8], 297[3], 298[5], 300[2], 304[4], 305[9], 315[3].
Van Duzee, E. P., mentioned, 30[5].
Vaney, cited, 315[4].
varia, Ephemera, 18[2].
variabilis, Chironomus, 272[6].
variabilis, Hexagenia, 18[2].
variabilis, Orthocladius, 273[7].
varipennis, Chironomus, 190[7], **201**[1].
varipes, Cricotopus, *see* Cricotopus varipes.
varius, Tanypus, 124[4].
Vayssiere, cited, 18[1], 20[9].
velutinus, Camptocladius, 260[2], **263**[7]–**64**[7].
venusta, Ablabesmyia, *see* Ablabesmyia venusta.
venustus, Chironomus, 241[7].
Verloren, cited, 315[4].
vernalis, Chironomus, 243[4].
vernus, Chironomus, 291[1].
Verrall, cited, 117[2], 315[4].
Vespa diabolica, 13[5].
vibratorius, Chironomus, 258[1].
viminalis, Oxyethira, *see* Oxyethira viminalis.
Vinen, cited, 315[4].
violacea, Argia, 14[6].
? virens, Tipula, 230[5].
virescens, Chironomus, 190[4].
virgo, Polymitarcys, 29[2], 60[1].
viridicollis, Chironomus, *see* Chironomus viridicollis.
viridipes, Chironomus, 211[7].
viridis, Chironomus, 195[5], 227[1], **230**[7].
vitiosus, Ceratopogon, 104[7].
Von Grimm, cited, 312[4].
von Waldheim, Fisher, cited, 315[4].
vulneratus, Chironomus, 230[6].

Wagner, cited, 315[5].
waldheimii, Chironomus, 241[2].
Walker, cited, 109[4], 110[1], 232[9], 245[8], 245[9], 246[3], 246[6], 247[2], 247[4], 247[6], 247[8], 248[1], 248[4], 248[6], 248[8], 267[7], 299[5], 315[5].
walkeri, Ephemerella, 43[6].
Walsh, cited, 18[1], 31[7].
waltlii, Diamesa, *see* Diamesa waltlii.
Wassmann, cited, 315[5].
Water skaters, 14[9].

Tanypus bicolor, 149[9].
choreus, 156[7], **159**[6]–**60**[2].
cinctus, 125[6], 155[9].
crassinervis, 156[6], **158**[4].
culiciformis, 156[4], 156[7], **158**[9]–**59**[6], 160[7]; explanation of plates, 325[6], 327[5].
decedens, 138[9], 156[9].
fasciatus, 159[2], 159[7].
monilis, 144[6].
nebulosus, 139[1].
nervosus, 134[1].
plumipes, 135[6].
posticalis, 156[6], **157**[9]–**58**[3]; explanation of plate, 330[7].
punctipennis, 125[6], 155[9].
stellatus, 156[3], **157**[1]; explanation of plate, 325[5].
sylvaticus, 159[8].
tenuis, 159[2].
tibialis, 156[8], **160**[3].
tricolor, 135[7].
(Procladius?) turpis, **127**[3], 135[7].
varius, 124[4].
Tanytarsus, 87[7], 88[3], 91[9], **284**[2]–**97**[8]; key to species, 285[1]–86[7].
sp., 286[2], **290**[4], **297**[3]; explanation of plates, 322[5], 322[6].
deflectus, 285[9], 286[2], **288**[1]; explanation of plates, 322[2], 326[8].
dissimilis, 285[3], 285[6], 286[4], 286[6], **292**[4]–**93**[8]; explanation of plates, 324[6], 327[8].
var. a, 285[6].
dives, 285[2], 285[5], 286[2], **288**[5]–**90**[4]; explanation of plates, 324[9]–25[1], 326[9], 327[9].
exiguus, 226[8], 285[3], 285[4], 286[7], 293[2], 293[5], **294**[7]–**96**[5]; explanation of plates, 325[2], 327[9].
fatigans, 286[4], **292**[1]; explanation of plate, 326[9].
flavellus, 286[7], **296**[9]–**97**[8]; explanation of plate, 326[9].
fulvescens, 286[5], **293**[9]–**94**[3]; explanation of plate, 326[9].
gmundensis, 285[2], 285[9], **287**[7]; explanation of plate, 326[8].
Tanytarsus junci, 286[3], **290**[9]–**91**[5].
muticus, 286[6], **294**[4]; explanation of plate, 326[9].
nigripilus, 285[8], **287**[3].
obediens, 285[8], 286[8]–87[3]; explanation of plate, 326[8].
pusio, 286[3], **291**[5].
sylvaticus, 287[3].
tenuis, 286[6], **296**[6].
Taylor, cited, 273[5], 315[1].
Telmatogeton, 88[7], 90[9], 93[4], 94[1], **168**[1]–**69**[1].
alaskensis, 169[1], **169**[2].
St Pauli, 168[2], 168[9]; explanation of plate, 328[3].
tendens, Chironomus, *see* Chironomus tendens.
tenellus, Chironomus, *see* Chironomus tenellus.
tentans, Chironomus, *see* Chironomus tentans.
tenuis, Tanypus, 159[2].
tenuis, Tanytarsus, 286[6], **296**[6].
ternarius, Bombus, 13[4].
Ternipus, 160[5].
Tersesthes, 92[4], 94[3], **95**[1]–**96**[4].
torrens, **96**[4]; explanation of plate, 328[9].
tetensii, Orthotrichia, 69[9], 75[9].
Tetragoneuria, 12[6], 14[8].
Tetraphora, 94[6], 99[5], **111**[5]; explanation of plate, 330[6].
fusca, 111[7].
Text figures, legenda to, 331[1].
Thalassomyia, 88[3], 91[8], **182**[8]–**86**[4], 307[5]; key to species, 183[3].
congregata, 88[9], 182[9], 183[1], 308[5].
frauenfeldi, 182[9], **186**[5], 308[8]; explanation of plate, 328[1].
fusca, 88[2], 174[5], 225[3], 271[3], 308[5]; explanation of plate, 326[3].
obscura, 182[9], 183[9], **184**[1]–**85**[8].
platypus, 183[9], **185**[8]–**86**[1].
Theobald, cited, 186[4], 315[2].
thoracicus, Procladius, 126[6], **129**[2].
tibialis, Ablabesmyia, *see* Ablabesmyia tibialis.
tibialis, Tanypus, 156[8], **160**[3].

Tipula, 142[5], 158[3], 201[9], 212[9], 218[4], 222[5], 252[8], 257[8], 262[4], 276[4], 283[6].
arundineti, 149[8].
cantans, 218[5].
littoralis, 218[5].
maculatus, 142[9].
? virens, 230[5].
Tipulid larva, 8[5].
Tipulidae, 13[7].
Tipulids, 81[7].
Tömösvary, cited, 182[9], 315[2].
torrens, Tersesthes, *see* Tersesthes torrens.
Tortricids, 178[1].
Townsend, cited, 101[9], 102[1], 315[7].
Treat, cited, 315[2].
tremulus, Cricotopus, 252[2], **252[7]–53[3]**.
triannulatus, Chironomus, 258[1].
trichomerus, Chironomus, 199[6], **248[6]**.
Trichoptera, 8[2], 11, 12[5], 14[3].
trichopterus, Forcipomyia, 100[9], 101[1].
tricinctus, Chironomus, 253[7].
tricolor, Procladius, 126[6], **130[9]–31[5]**.
tricolor, Tanypus, 135[7].
Tricorythus, 49[7].
trifasciatus, Cricotopus, *see* Cricotopus trifasciatus.
tristis, Chironomus, 213[5].
Tubipex, 123[9].
turpis, Procladius, 126[1].
turpis, Tanypus (Procladius), **127[3]**, 135[7].
tutatrix, Hemerobius, *see* Hemerobius tutatrix.

Ulmer, cited, 69[2], 295[1], 315[3].
umbrata, Sisyra, 15[4].
unicolor, Chironomus, 199[7].
unicolor, Eurycnemus, 298[7], **299[1]**.
unicornis, Ephemerella, **45[2]**.
unimaculatus, Chasmatonotus, 166[7], **167[1]**, **167[6]**.
univittatus, Chasmatonotus, 166[6], **167[4]**.
ursinus, Metriocnemus, 301[2], **304[8]–5[1]**.

Van der Wulp, cited, 140[4], 170[4], 182[7], 187[2], 212[1], 216[6], 216[7], 218[9], 227[3], 232[7], 244[2], 244[6], 255[2], 256[6], 261[7], 262[8], 297[3], 298[5], 300[2], 304[4], 305[9], 315[3].
Van Duzee, E. P., mentioned, 30[5].
Vaney, cited, 315[4].
varia, Ephemera, 18[2].
variabilis, Chironomus, 272[6].
variabilis, Hexagenia, 18[2].
variabilis, Orthocladius, 273[7].
varipennis, Chironomus, 190[7], **201[1]**.
varipes, Cricotopus, *see* Cricotopus varipes.
varius, Tanypus, 124[4].
Vayssiere, cited, 18[1], 20[9].
velutinus, Camptocladius, 260[6], **263[7]–64[3]**.
venusta, Ablabesmyia, *see* Ablabesmyia venusta.
venustus, Chironomus, 241[1].
Verloren, cited, 315[4].
vernalis, Chironomus, 243[4].
vernus, Chironomus, 291[1].
Verrall, cited, 117[5], 315[4].
Vespa diabolica, 13[5].
vibratorius, Chironomus, 258[1].
viminalis, Oxyethira, *see* Oxyethira viminalis.
Vimen, cited, 315[4].
violacea, Argia, 14[6].
? virens, Tipula, 230[8].
virescens, Chironomus, 190[4].
virgo, Polymitarcys, 29[2], 60[1].
viridicollis, Chironomus, *see* Chironomus viridicollis.
viridipes, Chironomus, 211[5].
viridis, Chironomus, 195[5], 227[1], **230[7]**.
vitiosus, Ceratopogon, 104[5].
Von Grimm, cited, 312[4].
von Waldheim, Fisher, cited, 315[4].
vulneratus, Chironomus, 236[9].

Wagner, cited, 315[7].
waldheimii, Chironomus, 241[2].
Walker, cited, 109[4], 110[1], 232[9], 245[5], 245[9], 246[3], 246[5], 247[2], 247[4], 247[6], 247[8], 248[1], 248[4], 248[6], 248[8], 267[7], 299[5], 315[5].
walkeri, Ephemerella, 43[6].
Walsh, cited, 18[1], 31[7].
waltlii, Diamesa, *see* Diamesa waltlii.
Wassmann, cited, 315[5].
Water skaters, 14[9].

Weith, R. J., acknowledgments to, 19[6]; mentioned, 30[7], 43[3], 47[6].
Weltner, cited, 315[5].
Westcott, O. S., specimens obtained by, 10[1].
Westwood, cited, 315[6].
Weyenbergh, cited, 111[9], 190[5], 212[1], 216[3], 243[4], 315[6].
White-gloved howdy, 31[5]–36[2].
Wiedemann, cited, 242[7], 315[7].
Willemoes-Suhm, cited, 315[7].
Williston, cited, 77[2], 82[2], 152[6], 233[4], 235[2], 235[6], 236[2], 258[8], 258[9], 315[7].
willistoni, Chironomus, 196[7], **235**[1].
Winnertz, cited, 112[7], 315[8].
Wulp, *see* Van der Wulp.
Wulpiella, 87[5], 90[7], **164**[7]–**65**[2].
scirpi, 164[8]; explanation of plate, 328[5].

Xylocrypta, 93[1], **104**[6].

Young, D. B., mentioned, 30[6], 36[7].

Zeller, cited, 315[5].
Zetterstedt, cited, 77[5], 215[9], 244[2], 273[7], 281[6], 283[6], 305[9], 315[9].
zonulus, Chironomus, 211[5].

New York State Museum

PUBLICATIONS

Postage or express to places outside of New York State must be paid in addition to the price given. On 10 or more copies of any one publication 20% discount will be given, the buyer to pay transportation. Editions printed are only large enough to meet special claims and probable sales. When the sale copies are exhausted, the price for the few reserve copies is advanced to that charged by secondhand booksellers, in order to limit their distribution to cases of special need. Such prices are inclosed in [ ]. All publications are in paper covers, unless binding is specified.

Museum annual reports 1847-date. *All in print to 1892, 50c a volume, 75c in cloth; 1892-date, 75c, cloth.*

These reports are made up of the reports of the director, geologist, paleontologist, botanist and entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

Geologist's annual reports 1881-date. Rept's 1, 3-13, 17-date, O; 2, 14-16, Q.

The annual reports of the early natural history survey, 1837–41 are out of print.

Reports 1–4, 1881–84 were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

Report	*Price*	*Report*	*Price*	*Report*	*Price*
12 (1892)	$.50	17	$.75	21	$.40
14	.75	18	.75	22	.40
15, 2v.	2	19	.40	23	*In press*
16	1	20	.50		

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899-1903. The two departments were reunited in 1904.

Paleontologist's annual reports 1899-1903.

See fourth note under Geologist's annual reports

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901–3 were issued as bulletins. In 1904 combined with geologist's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882-date.

Reports 3–19 bound also with museum reports 40–16, 43–57 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3–4 are out of print, other reports with prices are:

Report	*Price*	*Report*	*Price*	*Report*	*Price*
1	$.50	9	$.25	15 (En 9)	$.15
2	.30	10	.30	16 (" 10)	.25
5	.25	11	.25	17 (" 14)	.30
6	.15	12	.25	18 (" 17)	.20
7	.20	13	.10	19 (" 21)	.15
8	.25	14 (En 5)	.20	20 *In press*	

Reports 2, 8–12 may also be obtained bound separately in cloth at 25c in addition to the price given above.

Botanist's annual reports 1867-date.

Bound also with museum reports 21-date of which they form a part; the first botanist's report appeared in the 21st museum report and is numbered 21. Reports 21–24, 29, 31–41 were not published separately.

Separate reports 25–28, 30, 42–50 and 52 (Botany 3) are out of print. Report 51 may be had for 40c; 53 for 20c; 54 for 50c. Since the 55th these reports have been issued as bulletins.

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have been published in volumes 1 and 3 of the 48th museum report and in volume 1 of the 49th, 51st, 52d, 54th and 55th reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum memoir 4.

Museum bulletins 1887-date. O. *To advance subscribers, $2 a year or 50c a year for those of any one division:* (1) *geology, economic geology, mineralogy,* (2) *general zoology, archeology and miscellaneous,* (3) *paleontology,* (4) *botany,* (5) *entomology.*

Bulletins are also found with the annual reports of the museum as follows:

Bulletin	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*
G 1	48, v.1	Pa 1	54, v.1	En 7–9	53, v.1	Ar 3	52, v.1
2	51, v.1	2, 3	" v.3	10	54, v.2	4	54, v.1
3	52, v.1	4	" v.4	11	" v.3	5	" v.3
4	54, v.4	5, 6	55, v.1	12, 13	" v.4	6	55, v.4
5	55, v.1	7–8	56, v.2	14	55, v.1	7	56, v.4
Eg 5, 6	48, v.1	Z 3	53, v.1	15–18	56, v.3	Ms 1, 2	" v.4
7	50, v.1	4	54, v.1	Bo 3	52, v.1		
8	53, v.1	5–7	" v.3	4	53, v.1	*Memoir*	
9	54, v.2	8	55, v.1	5	55, v.1		
10	" v.3	9	56, v.3	6	56, v.4	2	49, v.3
11	56, v.1	En 3	48, v.1	Ar 1	50, v.1	3, 4	53, v.2
M 2	" v.1	4–6	52, v.1	2	51, v.1		

The figures in parenthesis indicate the bulletin's number as a New York State Museum bulletin.

Geology. G1 (14) Kemp, J. F. Geology of Moriah and Westport Townships, Essex Co. N. Y., with notes on the iron mines. 38p. 7pl. 2 maps. Sep. 1895. *10c.*

G2 (19) Merrill, F: J. H. Guide to the Study of the Geological Collections of the New York State Museum. 162p. 119pl. map. Nov. 1898. [*50c*]

G3 (21) Kemp, J. F. Geology of the Lake Placid Region. 24p. 1pl. map. Sep. 1898. *5c.*

G4 (48) Woodworth, J. B. Pleistocene Geology of Nassau County and Borough of Queens. 58p. il. 9pl. map. Dec. 1901. *25c.*

G5 (56) Merrill, F: J. H. Description of the State Geologic Map of 1901. 42p. 2 maps, tab. Oct. 1902. *10c.*

G6 (77) Cushing, H. P. Geology of the Vicinity of Little Falls, Herkimer Co. 98p. il. 15pl. 2 maps. Jan. 1905. *30c.*

Woodworth, J. B. Pleistocene Geology of the Mooers Quadrangle. *In press.*

——— Ancient Water Levels of the Champlain and Hudson Valleys. *In press.*

Cushing, H. P. Geology of the Northeast Adirondack Region. *In press.*

Ogilvie, I. H. Geology of the Paradox Lake Quadrangle. *In press.*

Economic geology. Eg1 (3) Smock, J: C. Building Stone in the State of New York. 152p. Mar. 1888. *Out of print.*

Eg2 (7) —— First Report on the Iron Mines and Iron Ore Districts in the State of New York. 6+70p. map. June 1889. *Out of print.*

Eg3 (10) —— Building Stone in New York. 210p. map, tab. Sep. 1890. *40c.*

Eg4 (11) Merrill, F: J. H. Salt and Gypsum Industries of New York. 92p. 12pl. 2 maps, 11 tab. Ap. 1893. [*50c*]

Eg5 (12) Ries, Heinrich. Clay Industries of New York. 174p. 2pl. map. Mar. 1895. *30c.*

Eg6 (15) Merrill, F: J. H. Mineral Resources of New York. 224p. 2 maps. Sep. 1895. [*50c*]

Eg7 (17) —— Road Materials and Road Building in New York. 52p. 14pl. 2 maps 34x45, 68x92 cm. Oct. 1897. *15c.*

Maps separate *10c each, two for 15c.*

Eg8 (30) Orton, Edward. Petroleum and Natural Gas in New York. 136p. il. 3 maps. Nov. 1899. *15c.*

Eg9 (35) Ries, Heinrich. Clays of New York; their Properties and Uses. 456p. 140pl. map. June 1900. *$1, cloth.*

Eg10 (44) —— Lime and Cement Industries in New York; Eckel, E. C. Chapters on the Cement Industry. 332p. 101pl. 2 maps. Dec. 1901. *85c, cloth.*

Eg11 (61) Dickinson, H. T. Quarries of Bluestone and other Sandstones in New York. 108p. 18pl. 2 maps. Mar. 1903. *35c.*

Eg12 (85) Rafter, G: W. Hydrology of New York State. 902p. il. 44pl. 5 maps. May 1905. *$1.50, cloth.*

Mineralogy. M1 (4) Nason, F. L. Some New York Minerals and their Localities. 20p. 1pl. Aug. 1888. [*10c*]

M2 (58) Whitlock, H. P. Guide to the Mineralogic Collections of the New York State Museum. 150p. il. 39pl. 11 models. Sep. 1902. *40c.*

M3 (70) —— New York Mineral Localities. 110p. Sep. 1903. *20c.*

Paleontology. Pa1 (34) Cumings, E. R. Lower Silurian System of Eastern Montgomery County; Prosser, C: S. Notes on the Stratigraphy of Mohawk Valley and Saratoga County, N. Y. 74p. 10pl. map. May 1900. *15c.*

Pa2 (39) Clarke, J: M.; Simpson, G. B. & Loomis, F: B. Paleontologic Papers 1. 72p. il. 16pl. Oct. 1900. *15c.*

Contents: Clarke, J: M. A Remarkable Occurrence of Orthoceras in the Oneonta Beds of the Chenango Valley, N. Y.
——Paropsonema cryptophya; a peculiar Echinoderm from the Intumescens-zone (Portage Beds) of Western New York.
——Dictyonine Hexactinellid Sponges from the Upper Devonic of New York.
——The Water Biscuit of Squaw Island, Canandaigua Lake, N. Y.
Simpson, G: B. Preliminary Descriptions of New Genera of Paleozoic Rugose Corals.
Loomis, F: B. Siluric Fungi from Western New York.

Pa3 (42) Ruedemann, Rudolf. Hudson River Beds near Albany and their Taxonomic Equivalents. 114p. 2pl. map. Ap. 1901. *25c.*

Pa4 (45) Grabau, A. W. Geology and Paleontology of Niagara Falls and Vicinity. 286p. il. 18pl. map. Ap. 1901. *65c; cloth, 90c.*

Pa5 (49) Ruedemann, Rudolf; Clarke, J: M. & Wood, Elvira. Paleontologic Papers 2. 240p. 13pl. Dec. 1901. *40c.*

Contents: Ruedemann, Rudolf. Trenton Conglomerate of Rysedorph Hill.
Clarke, J: M. Limestones of Central and Western New York Interbedded with Bituminous Shales of the Marcellus Stage.
Wood, Elvira. Marcellus Limestones of Lancaster, Erie Co. N. Y.
Clarke, J: M. New Agelacrinites.
——Value of Amnigenia as an Indicator of Fresh-water Deposits during the Devonic of New York, Ireland and the Rhineland.

Pa6 (52) Clarke, J: M. Report of the State Paleontologist 1901. 280p. il. 9pl. map, 1 tab. July 1902. *40c.*

Pa7 (63) —— Stratigraphy of Canandaigua and Naples Quadrangles. 78p. map. June 1904. *25c.*

Pa8 (65) —— Catalogue of Type Specimens of Paleozoic Fossils in the New York State Museum. 848p. May 1903. *$1.20, cloth.*

Pa9 (69) —— Report of the State Paleontologist 1902. 464p. 52pl. 8 maps. Nov. 1903. *$1, cloth.*

Pa10 (80) —— Report of the State Paleontologist 1903. 396p. 20pl. map. Feb. 1905. *85c, cloth.*

Pa11 (81) —— & Luther, D. D. Watkins and Elmira Quadrangles. 32p. map. Mar. 1905. *25c.*

Pa12 (82) —— Geologic Map of the Tully Quadrangle. 40p. map. Ap. 1905. *20c.*

Grabau, A. W. Guide to the Geology and Paleontology of the Schoharie Region. *In press.*

Ruedemann, Rudolf. Cephalopoda of Beekmantown and Chazy Formations of Champlain Basin. *In preparation.*

Zoology. Z1 (1) Marshall, W: B. Preliminary List of New York Unionidae. 20p. Mar. 1892. *5c.*

Z2 (9) —— Beaks of Unionidae Inhabiting the Vicinity of Albany, N. Y. 24p. 1pl. Aug. 1890. *10c.*

Z3 (29) Miller, G. S. jr. Preliminary List of New York Mammals. 124p. Oct. 1899. *15c.*

Z4 (33) Farr, M. S. Check List of New York Birds. 224p. Ap. 1900. *25c.*

Z5 (38) Miller, G. S. jr. Key to the Land Mammals of Northeastern North America. 106p. Oct. 1900. *15c.*

Z6 (40) Simpson, G: B. Anatomy and Physiology of Polygyra albolabris and Limax maximus and Embryology of Limax maximus. 82p. 28pl. Oct. 1901. *25c.*

Z7 (43) Kellogg, J. L. Clam and Scallop Industries of New York. 36p. 2pl. map. Ap. 1901. *10c.*

Z8 (51) Eckel, E. C. & Paulmier, F. C. Catalogue of Reptiles and Batrachians of New York. 64p. il. 1pl. Ap. 1902. *15c.*

Eckel, E. C. Serpents of Northeastern United States.
Paulmier, F. C. Lizards, Tortoises and Batrachians of New York.

Z9 (60) Bean, T. H. Catalogue of the Fishes of New York. 784p. Feb. 1903. *$1, cloth.*

Z10 (71) Kellogg, J. L. Feeding Habits and Growth of Venus mercenaria. 30p. 4pl. Sep. 1903. *10c.*

Z11 (88) Letson, Elizabeth J. Check List of New York Mollusca. 114p. May 1905. *20c.*

Paulmier, F. C. Higher Crustacea of New York City. *In press.*

Eaton, E. H. Birds of New York. *In preparation.*

Entomology. En1 (5) Lintner, J. A. White Grub of the May Beetle. 32p. il. Nov. 1888. *10c.*

En2 (6) —— Cut-worms. 36p. il. Nov. 1888. *10c.*

En3 (13) —— San José Scale and Some Destructive Insects of New York State. 54p. 7pl. Ap. 1895. *15c.*

En4 (20) Felt, E. P. Elm-leaf Beetle in New York State. 46p. il. 5pl. June 1898. *5c.*

See En15.

En5 (23) —— 14th Report of the State Entomologist 1898. 150p. il. 9pl. Dec. 1898. *20c.*

En6 (24) —— Memorial of the Life and Entomologic Work of J. A. Lintner Ph.D. State Entomologist 1874-98; Index to Entomologist's Reports 1-13. 316p. 1pl. Oct. 1899. *35c.*

Supplement to 14th report of the state entomologist.

En7 (26) —— Collection, Preservation and Distribution of New York Insects. 36p. il. Ap. 1899. *5c.*

En8 (27) —— Shade Tree Pests in New York State. 26p. il. 5pl. May 1899. *5c.*

En9 (31) —— 15th Report of the State Entomologist 1899. 128p. June 1900. *15c.*

En10 (36) —— 16th Report of the State Entomologist 1900. 118p. 16pl. Mar. 1901. *25c.*

En11 (37) —— Catalogue of Some of the More Important Injurious and Beneficial Insects of New York State. 54p. il. Sep. 1900. *10c.*

En12 (46) —— Scale Insects of Importance and a List of the Species in New York State. 94p. il. 15pl. June 1901. *25c.*

En13 (47) Needham, J. G. & Betten, Cornelius. Aquatic Insects in the Adirondacks. 234p. il. 36pl. Sep. 1901. *45c.*

En14 (53) Felt, E. P. 17th Report of the State Entomologist 1901. 232p. il. 6pl. Aug. 1902. *30c.*

En15 (57) —— Elm Leaf Beetle in New York State. 46p. il. 8pl. Aug. 1902. *15c.*

This is a revision of En4 containing the more essential facts observed since that was prepared.

En16 (59) —— Grapevine Root Worm. 40p. 6pl. Dec. 1902. *15c.*

See En19.

En17 (64) —— 18th Report of the State Entomologist 1902. 110p. 6pl. May 1903. *20c.*

En18 (68) Needham, J. G. *& others.* Aquatic Insects in New York. 322p. 52pl. Aug. 1903. *80c, cloth.*

En19 (72) Felt, E. P. Grapevine Root Worm. 58p. 13pl. Nov. 1903. *20c.*

This is a revision of En16 containing the more essential facts observed since that was prepared.

En20 (74) —— & Joutel, L. H. Monograph of the Genus Saperda. 88p. 14pl. June 1904. *25c.*

En21 (76) Felt, E. P. 19th Report of the State Entomologist 1903. 150p. 4pl. 1904. *15c.*

En22 (79) —— Mosquitos or Culicidae of New York. 164p. il. 57pl. Oct. 1904. *40c.*

En23 (86) Needham, J. G. *& others.* May Flies and Midges of New York. 352p. il. 37pl. *80c, cloth.*

Felt, E. P. 20th Report of the State Entomologist 1904. *In press.*

Botany. Bo1 (2) Peck, C: H. Contributions to the Botany of the State of New York. 66p. 2pl. May 1887. *Out of print.*

Bo2 (8) —— Boleti of the United States. 96p. Sep. 1889. [*50c*]

Bo3 (25) —— Report of the State Botanist 1898. 76p. 5pl. Oct. 1899. *Out of print.*

Bo4 (28) —— Plants of North Elba. 206p. map. June 1899. *20c.*
Bo5 (54) —— Report of the State Botanist 1901. 58p. 7pl. Nov. 1902. *40c.*
Bo6 (67) —— Report of the State Botanist 1902. 196p. 5pl. May 1903. *50c.*
Bo7 (75) —— Report of the State Botanist 1903. 70p. 4pl. 1904. *40c.*
—— Report of the State Botanist 1904. *In press.*

Archeology. Ar1 (16) Beauchamp, W: M. Aboriginal Chipped Stone Implements of New York. 86p. 23pl. Oct. 1897. *25c.*
Ar2 (18) —— Polished Stone Articles used by the New York Aborigines. 104p. 35pl. Nov. 1897. *25c.*
Ar3 (22) —— Earthenware of the New York Aborigines. 78p. 33pl. Oct. 1898. *25c.*
Ar4 (32) —— Aboriginal Occupation of New York. 190p. 16pl. 2 maps. Mar. 1900. *30c.*
Ar5 (41) —— Wampum and Shell Articles used by New York Indians. 166p. 28pl. Mar. 1901. *30c.*
Ar6 (50) —— Horn and Bone Implements of the New York Indians. 112p. 43pl. Mar. 1902. *30c.*
Ar7 (55) —— Metallic Implements of the New York Indians. 94p. 38pl. June 1902. *25c.*
Ar8 (73) —— Metallic Ornaments of the New York Indians. 122p. 37pl. Dec. 1903. *30c.*
Ar9 (78) —— History of the New York Iroquois. 340p. 17pl. map. Feb. 1905. *75c, cloth.*
Ar10 (87) —— Perch Lake Mounds. 84p. 12pl. Ap. 1905. *20c.*
—— Aboriginal Use of Wood in New York. *In press.*

Miscellaneous. Ms1 (62) Merrill, F: J. H. Directory of Natural History Museums in United States and Canada. 236p. Ap. 1903. *30c.*
Ms2 (66) Ellis, Mary. Index to Publications of the New York State Natural History Survey and New York State Museum 1837-1902. 418p. June 1903. *75c, cloth.*

Museum memoirs 1889-date. Q.

1 Beecher, C: E. & Clarke, J: M. Development of some Silurian Brachiopoda. 96p. 8pl. Oct. 1889. *Out of print.*
2 Hall, James & Clarke, J: M. Paleozoic Reticulate Sponges. 350p. il. 70pl. 1898. *$1, cloth.*
3 Clarke, J: M. The Oriskany Fauna of Becraft Mountain, Columbia Co. N. Y. 128p. 9pl. Oct. 1900. *80c.*
4 Peck, C: H. N. Y. Edible Fungi, 1895-99. 106p. 25pl. Nov. 1900. *75c.*
This includes revised descriptions and illustrations of fungi reported in the 49th, 51st and 52d reports of the state botanist.
5 Clarke, J: M. & Ruedemann, Rudolf. Guelph Formation and Fauna of New York State. 196p. 21pl. July 1903. *$1.50, cloth.*
6 —— Naples Fauna in Western New York. 268p. 26pl. map. *$2, cloth.*
7 Ruedemann, Rudolf. Graptolites of New York. Pt 1 Graptolites of the Lower Beds. 350p. 17pl. Feb. 1905. *$1.50, cloth.*

Felt E. P. Insects Affecting Park and Woodland Trees. *In press.*
Clarke, J: M. Early Devonic of Eastern New York. *In preparation.*

Natural history of New York. 30v. il. pl. maps. Q. Albany 1842-94.

DIVISION 1 ZOOLOGY. De Kay, James E. Zoology of New York; or, The New York Fauna; comprising detailed descriptions of all the animals hitherto observed within the State of New York with brief notices of those occasionally found near its borders, and accompanied by appropriate illustrations. 5v. il. pl. maps. sq. Q. Albany 1842-44. *Out of print.*
Historical introduction to the series by Gov. W: H. Seward. 178p.

v. 1 pt1 Mammalia. 13+146p. 33pl. 1842.
300 copies with hand-colored plates.

v. 2 pt2 Birds. 12+380p. 141pl. 1844.
Colored plates.

v. 3 pt3 Reptiles and Amphibia. 7+98p. pt4 Fishes. 15+415p. 1842.
pt3-4 bound together.

v. 4 Plates to accompany v. 3. Reptiles and Amphibia 23pl. Fishes 79pl. 1842.
300 copies with hand-colored plates.

v. 5 pt5 Mollusca. 4+271p. 40pl. pt6 Crustacea. 70p. 13pl. 1843-44.
Hand-colored plates: pt5-6 bound together.

DIVISION 2 BOTANY. Torrey, John. Flora of the State of New York; comprising full descriptions of all the indigenous and naturalized plants hitherto discovered in the State, with remarks on their economical and medical properties. 2v. il. pl. sq. Q. Albany 1843. *Out of print.*

v. 1 Flora of the State of New York. 12+484p. 72pl. 1843.
300 copies with hand-colored plates.

v. 2 Flora of the State of New York. 572p. 89pl. 1843.
300 copies with hand-colored plates.

DIVISION 3 MINERALOGY. Beck, Lewis C. Mineralogy of New York; comprising detailed descriptions of the minerals hitherto found in the State of New York, and notices of their uses in the arts and agriculture. il. pl. sq. Q. Albany 1842. *Out of print.*

v. 1 pt1 Economical Mineralogy. pt2 Descriptive Mineralogy. 24+536p. 1842.
8 plates additional to those printed as part of the text.

DIVISION 4 GEOLOGY. Mather, W: W.; Emmons, Ebenezer; Vanuxem, Lardner & Hall, James. Geology of New York. 4v. il. pl. sq. Q. Albany 1842-43. *Out of print.*

v. 1 pt1 Mather, W: W. First Geological District. 37+653p. 46pl. 1843.

v. 2 pt2 Emmons, Ebenezer. Second Geological District. 10+437p. 17pl. 1842.

v. 3 pt3 Vanuxem, Lardner. Third Geological District. 306p. 1842.

v. 4 pt4 Hall, James. Fourth Geological District. 22+683p. 19pl. map. 1843.

DIVISION 5 AGRICULTURE. Emmons, Ebenezer. Agriculture of New York; comprising an account of the classification, composition and distribution of the soils and rocks and the natural waters of the different geological formations, together with a condensed view of the meteorology and agricultural productions of the State. 5v. il. pl. sq. Q. Albany 1846-54. *Out of print.*

v. 1 Soils of the State, their Composition and Distribution. 11+371p. 21pl. 1846.

v. 2 Analysis of Soils, Plants, Cereals, etc. 8+343+46p. 42pl. 1849.
With hand-colored plates.

v. 3 Fruits, etc. 8+340p. 1851.

v. 4 Plates to accompany v. 3. 95pl. 1851.
Hand-colored.

v. 5 Insects Injurious to Agriculture. 8+272p. 50pl. 1854.
With hand-colored plates.

DIVISION 6 PALEONTOLOGY. Hall, James. Palaeontology of New York. 8v. il. pl. sq. Q. Albany 1847-94. *Bound in cloth.*

v. 1 Organic Remains of the Lower Division of the New York System. 23+338p. 99pl. 1847. *Out of print.*

v. 2 Organic Remains of Lower Middle Division of the New York System. 8+362p. 104pl. 1852. *Out of print.*

v. 3 Organic Remains of the Lower Helderberg Group and the Oriskany Sandstone. pt1, text. 12+532p. 1859. [*$3.50*]

—— pt2, 143pl. 1861. [*$2.50*]

v. 4 Fossil Brachiopoda of the Upper Helderberg, Hamilton, Portage and Chemung Groups. 11+1+428p. 99pl. 1867. *$2.50.*

v. 5 pt1 Lamellibranchiata 1. Monomyaria of the Upper Helderberg, Hamilton and Chemung Groups. 18+268p. 45pl. 1884. *$2.50.*

—— —— Lamellibranchiata 2. Dimyaria of the Upper Helderberg, Hamilton, Portage and Chemung Groups. 62+293p. 51pl. 1885. *$2.50.*

—— pt2 Gasteropoda, Pteropoda and Cephalopoda of the Upper Helderberg, Hamilton, Portage and Chemung Groups. 2v. 1879. v. 1, text. 15+492p. v. 2, 120pl. *$2.50 for 2 v.*

v. 6 Corals and Bryozoa of the Lower and Upper Helderberg and Hamilton Groups. 24+298p. 67pl. 1887. *$2.50.*

v. 7 Trilobites and other Crustacea of the Oriskany, Upper Helderberg, Hamilton, Portage, Chemung and Catskill Groups. 64+236p. 46pl. 1888.

Cont. supplement to v. 5, pt2. Pteropoda, Cephalopoda and Annelida. 42p. 18pl. 1888. *$2.50.*

v. 8 pt1 Introduction to the Study of the Genera of the Paleozoic Brachiopoda. 16+367p. 44pl. 1892. *$2.50.*

—— pt2 Paleozoic Brachiopoda. 16+394p. 84pl. 1894. *$2.50.*

Catalogue of the Cabinet of Natural History of the State of New York and of the Historical and Antiquarian Collection annexed thereto. 242p. O. 1853.

Handbooks 1893-date. 7½x12½ cm.

In quantities, 1 cent for each 16 pages or less. Single copies postpaid as below.

H5 New York State Museum. 52p. il. *4c.*

Outlines history and work of the museum with list of staff 1902.

H13 Paleontology. 12p. *2c.*

Brief outline of State Museum work in paleontology under heads: Definition; Relation to biology; Relation to stratigraphy; History of paleontology in New York.

H15 Guide to Excursions in the Fossiliferous Rocks of New York. 124p. *8c.*

Itineraries of 32 trips covering nearly the entire series of Paleozoic rocks, prepared specially for the use of teachers and students desiring to acquaint themselves more intimately with the classic rocks of the State.

H16 Entomology. 16p. *2c.*

H17 Economic Geology. 44p. *4c.*

H18 Insecticides and Fungicides. 20p. *3c.*

H19 Classification of New York Series of Geologic Formations. 32p. *3c.*

Maps. Merrill, F: J. H. Economic and Geologic Map of the State of New York; issued as part of Museum bulletin 15 and the 48th Museum Report, v. 1. 59x67 cm. 1894. Scale 14 miles to 1 inch. *15c.*

—— Geologic Map of New York. 1901. Scale 5 miles to 1 inch. *In atlas form $3; mounted on rollers $5. Lower Hudson sheets 60c.*

The lower Hudson sheet, geologically colored, comprises Rockland, Orange, Dutchess, Putnam, Westchester, New York, Richmond, Kings, Queens and Nassau counties, and parts of Sullivan, Ulster and Suffolk counties; also northeastern New Jersey and part of western Connecticut.

—— Map of New York showing the Surface Configuration and Water Sheds. 1901. Scale 12 miles to 1 inch. *15c.*

Geologic maps on the United States Geological Survey topographic base; scale 1 in. = 1 m. Those marked with an asterisk have also been published separately.

*Albany county. Mus. rep't 49, v. 2. 1898. *50c.*

Area around Lake Placid. Mus. bul. 21. 1898.

Vicinity of Frankfort Hill [parts of Herkimer and Oneida counties]. Mus. rep't 51, v. 1. 1899.

Rockland county. State geol. rep't 18. 1899.

Amsterdam quadrangle. Mus. bul. 34. 1900.

*Parts of Albany and Rensselaer counties. Mus. bul. 42. 1901. *10c.*

*Niagara River. Mus. bul. 45. 1901. *25c.*

Part of Clinton county. State geol. rep't 19. 1901.

Oyster Bay and Hempstead quadrangles on Long Island. Mus. bul. 48. 1901.

Portions of Clinton and Essex counties. Mus. bul. 52. 1902.

Part of town of Northumberland, Saratoga co. State geol. rep't 21. 1903.

Union Springs, Cayuga county and vicinity. Mus. bul. 69. 1903.

*Olean quadrangle. Mus. bul. 69. 1903. *10c.*

Becraft Mt with 2 sheets of sections. (Scale 1 in. = ½ m.) Mus. bul. 69. 1903. *20c.*

*Canandaigua-Naples quadrangles. Mus. bul. 63. 1904. *20c.*

*Little Falls quadrangle. Mus. bul. 77. 1905. *15c.*

*Watkins-Elmira quadrangle. Mus. bul. 81. 1905. *20c.*

*Tully quadrangle. Mus. bul. 82. 1905. *10c.*

*Salamanca quadrangle. Mus. bul. 80. 1905. *10c.*

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.